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JUN 17 1946

HEATING AND VENTILATING

AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION

Preventing
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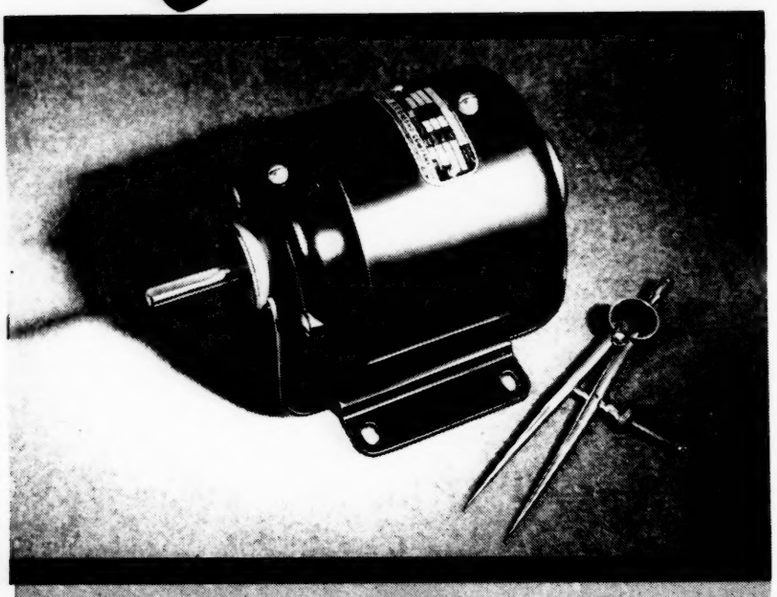
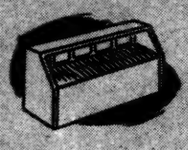
"Customer Engineering Service"

ASSURES PROPER USE OF

Redmond MICROMOTORS



The Redmond Type "T" totally enclosed shaded pole A.C. Micromotor, illustrated above, has its own enclosed fan cooling system and is built in sizes up to 1/25th horsepower. Below are shown Micromotor applications which are typical of those on which Redmond "Customer Engineering Service" offers valuable assistance for assuring best results.



DISPLAY COOLERS

AGITATORS

CHURNS

AIR CONDITIONERS

OIL BURNERS

WINDOW VENTILATORS

UNIT HEATERS

BLOWERS

OIL BURNERS

Whenever you have a small motor problem feel free to call on us for *"Customer Engineering Service"*.

Redmond COMPANY, INC.
OWOSSO, MICHIGAN, U. S. A.

REDMOND KNOWS MOTORS
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REDMOND

VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL AIR CONDITIONING, REFRIGERATION, AIR SANITATION, PIPING, HEATING AND VENTILATION

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MEMBER
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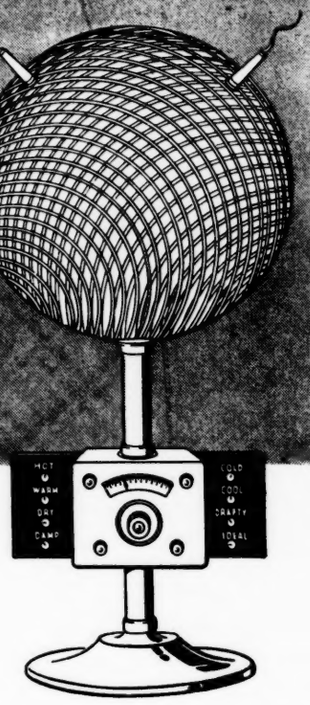
THIS MONTH'S COVER

Photo shows loading of a meat cargo. Perishable and metallic cargoes require special care in maintaining proper conditions in the hold. See page 53. Photo by Harold Lambert from Frederic Lewis.

"ROBERTA" Reacts to Sunshine IN A SNOWSTORM

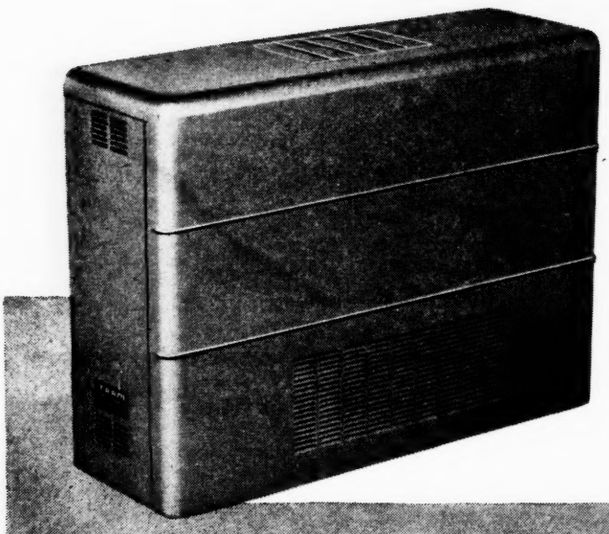


How the Modern Miracle of Electronics Helps Trane Create Better Weather Magic

"Roberta," according to Trane technicians, can be called an Eupatheometer. When Trane engineers in the development of new heating systems wanted to know just what made a person comfortable they had two alternatives. They could take a score of human guinea pigs and subject them to all kinds of heat, wind and sun effects or they could turn to electronics and make a machine that would do the same thing. They did the latter and created "Roberta."

"Roberta," the human-comfort meter, is one of the prima donnas of the Trane Laboratories. And she certainly deserves the title. She's so sensitive that she'll record the heat of the sun during a snowstorm. Or react to the air motion created by a wave of the hand. So taut are her nerves that the Btu's given off by a mouse will set her in a dither. She measures the factors that affect human comfort better than the human body itself and then proceeds to record them accurately and completely.

Now! A POST-WAR TRIUMPH OF TRANE ENGINEERING . . . THE TRANE CUSTOM-AIR SYSTEM



Another Trane FIRST can now be announced! Trane research engineers have worked for ten years to perfect the new Trane Custom-Air System — the ideal solution to the problem of air conditioning multi-story, multi-room buildings.

Here is a completely modern air conditioning system. This latest result of Trane engineering combines the advantages of a central system with the flexibility of individual units, and affects new savings in space in new or old buildings. The new Trane Custom-Air System *automatically* provides a new standard of comfort — summer, winter, and between seasons.

This newest example of Trane Weather Magic, like all Trane systems, makes efficient use of many of the complete line of Trane products for heat transfer and air handling. Complete information and technical details on the new Trane Custom-Air System are available only through your Trane field engineer.

Washington News

LORING F. OVERMAN

Strikes.
New Pricing Technique.
Colleges Overwhelmed.
Unrealistic Building Codes.

WASHINGTON was not too proud of itself during the closing weeks of March. To find itself virtually helpless before the power of organized labor was somewhat of a shock to those who, many believe, had not hesitated to ride rough-shod over management at the slightest provocation.

Many muttered that "There ought to be a law." These were understandably chagrined when reminded that there *is* a law—the Wagner Labor Relations Act —responsible for bringing the unions into power, but devoid of provisions to curb the unleashed genie. Their obvious conclusion was that any law that permits the will of a few to thwart the best interests of 140,000,000 persons should certainly be changed.

And there the matter stood as this column was being written. The rail strike had been broken, Congress was in a mood to try to balance the power between mangement and labor, and it was assumed that the coal strike settlement would not long be delayed.

Much Harm Done

While some good may come out of bringing the crisis to a head, the irreparable damage already done by the steel and coal strikes alone was forcefully illustrated by reports issued on May 21 covering anticipated steel production for 1946. Estimates placed total production for the year at 48,000,000 tons—17% below the pre-strike estimate of 58 million tons, and 660,000 tons below the 1940 total of 48,660,000.

A breakdown indicated that the automotive industry would be hardest hit, at 33% below pre-strike estimates. Other losses were estimated as follows: agricultural implements, 11%; construction, 3%; containers, 13%; machinery and tools, 14%; oil, gas, water and mining, 21%; pressing, forming and stamping, including furniture and furnishings, 14%; railroads, 8%; shipbuilding, 12%; exports, 40% and miscellaneous, 6%.

Other Metals Affected

When one recalls the production peaks to which metals of all types rose during the war, it is difficult to realize that supplies of not only steel, but copper, lead, tin and even aluminum sheet are now at such low ebbs that a definite priorities schedule is again being urged upon the Civilian Production Administration as the only solution. Currently a voluntary rationing plan is in effect, with suppliers requested to apportion deliveries so that no individual customer or class of customer will receive "more than needed for immediate use." Many small and new users have complained to CPA that there is discrimination in favor of longer established firms despite provisions of the Reconversion Act of 1944, favoring small business and veterans.

There seems little likelihood of a return to formal priorities for metals, but a wider use of CC ratings under Priorities Regulation 28, for small business, veterans, and for such urgent needs as housing, farm machinery, railroads and relief exports may be anticipated.

Relatively little publicity has been given the copper situation, but the industry has been embroiled in strikes and price uncertainties which reduced April output of refined copper to less than 20,000 tons, the lowest in recent years. Refined copper on hand amounts to little more than 60,000 tons, and copper imports which had been counted upon to relieve the pinch have failed to arrive. Explanation of this latter development is that the U. S. price offer is below those made by Great Britain and other countries. Thus, the copper industry contends, its price squabble with OPA is holding up imports as well as domestic production.

Assuming the coal strike is settled, copper may be expected to follow quickly, for copper management is reported to have seen little need for hurry as long as the coal situation prevented full scale production anyway. Industry seeks a 15c per pound price for copper, up 3c from the present 12c ceiling. OPA is reported to have offered 14.3c, a figure which would permit settling of strikes by granting an 18½c wage increase already approved by the Wage Stabilization Board for Anaconda Copper employees.

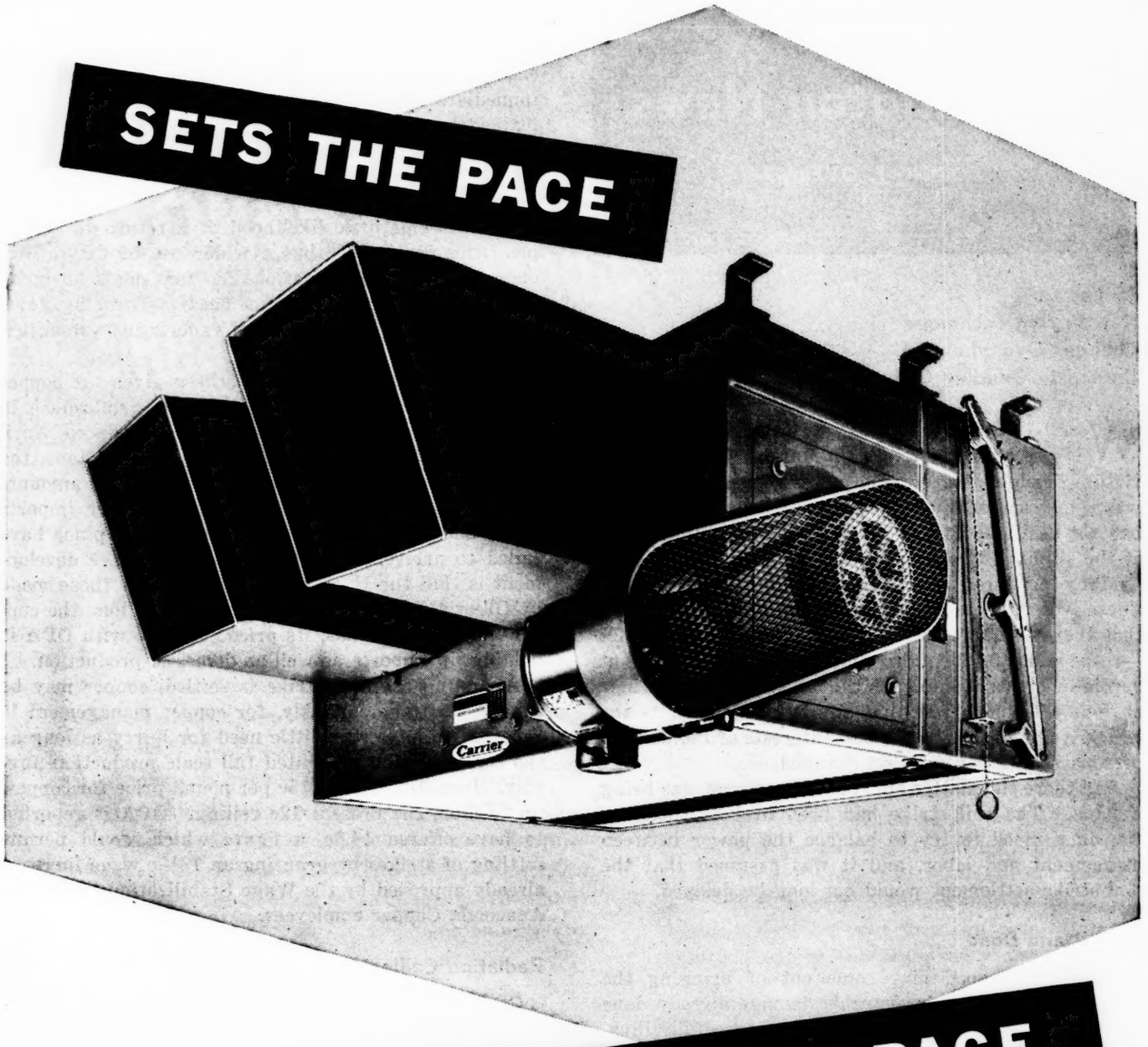
Radiation Ceiling Up

Cast iron heating boiler ceilings were raised 15% and cast iron radiation list prices were upped 2c per square foot, effective May 21, by Amendment 9 to Maximum Price Regulation 272. Further relief is granted the industry by limiting manufacturers' obligations to absorbed freight charges on shipments of 200 pounds or over to the first 60 pounds cwt. Formerly OPA required an allowance of the full car load rate of freight. Resellers of boilers may also increase their resale prices by 15%. Resellers of radiation may pass on only the actual dollars-and-cents increase granted manufacturers, rounded to the nearest ½c per square foot.

Self-pricing Due

Washington now appears convinced of the fallacy of its initial contention—that wages can be raised without increasing prices. As a result OPA is somewhat unwillingly following along, granting increases to spur production of short items, and decontrolling hundreds of items of minor importance. Now in the drafting stage is an OPA order to permit automatic cost-plus pricing. The order is expected to make its appearance with little publicity, limited at first to a few comparatively insignificant items. Its significance

SETS THE PACE



IN HEATING SPACE

HERE's a rugged, blower-type unit that brings new efficiency and economy to heating and ventilating the large enclosed space of factories, warehouses, hangars, garages, super-markets, and similar buildings. It's the Carrier 46R Heat Diffusing Unit . . . designed for superior service and all-round saving.

Heat diffusion by the 46R is wide and uniform. A variety of outlets permits air to be discharged at any desired angle. Belt-driven fans provide a wide range of speeds and capacities. Unit is suitable for either steam or hot water. Either standard Aerofin coils of U-bend tubing or steam distributing Non-Freeze tube coils of Aerofin construction are available.

The 46R has no screwed joints or compression fittings. Possibilities of leaks are greatly reduced. Construction is sectionalized for easy handling and installation. Fitted with clips for horizontal suspension. Floor-mounted or vertical-suspended units also available.

Carrier Heat Diffusers are engineered as complete units to keep *efficiency high, costs low.* They're backed by all the skill of Carrier's long experience. If you have a heating or ventilating question, why not put it up to the experts on Carrier's technical staff? There's no obligation. Carrier Corporation, Syracuse, New York.

Carrier

AIR CONDITIONING
REFRIGERATION
INDUSTRIAL HEATING

should not be overlooked, however, for it is expected to set a pattern which can be adapted quickly to both large and small manufacturers. OPA will furnish a profit factor considered the average for the industry under prewar conditions. But the individual company will compute its own costs, calculate its own price by adding the OPA profit factor, and go ahead, merely by informing OPA of its new price. OPA will reserve the right to cut back the prices, without making them retroactive, if they are considered too high.

While the order in its initial form will cover only a few items, it should be studied by pricing executives with a view to preparing their cases for inclusion.

Price Spiral Moving

If there be any doubt that the price line is broken, it is only necessary to skim over a few of the price increases recently granted, or in the mill. Among others, building material industries received 84 price increases during the January-April period. Brick, tile, lumber, gypsum products, cement, builders' hardware, domestic oil burners and radiation are among the products covered. Fuel price increases numbered 17, and a coal price rise will follow a wage increase for coal miners. The coal price is expected to go up 25 to 50 cents per ton—the 25c figure being only sufficient to cover the 18.5c-an-hour increase in wages. The welfare fund, if decided upon, would make up the balance of the increase estimated.

Freight rates are due for an increase too, and it is expected that about the time all this adjusting is well along, labor will be back for another increase, and the inflation spiral will be nearing the before-deflation ceiling.

Educational Deluge

Just why the educational provisions of the G.I. Bill of Rights should be of direct interest to the heating, ventilating and air-conditioning industries may at first appear obscure. The answer lies in the fact that Uncle Sam has promised free education for any young man or woman who entered the service, with the result that college facilities of the country are literally swamped. Projected plans for the physical plants of the institutions of higher education now call for an expenditure of $1,500,000,000. Required are just the type of modern buildings in which products of the heating, ventilating and air-conditioning industries will be required.

Engineers, architects and manufacturers whose talents or products fit the college field will find there a ready-made market having the blessings of the Veterans' Administration and the priorities assistance of the National Housing Administration and the Civilian Production Administration. It is estimated that more than 2,000,000 will apply for admission to colleges and universities next September; 970,000 of these will be veterans. Unless quick action is taken in providing both housing and educational buildings, educational institutions will be able to accommodate only 1,600,000, surveys reveal.

The housing problem is considered the worst problem, even though the Government plans to turn over government-owned buildings, moving and erecting them at Federal expense. Other buildings will be converted at college expense, with beds, bedding and furnishings supplied by the government. Also some of the armed forces camps and other establishments will be used on their present sites.

In addition to the $1,500,000,000 projected for plant improvement, the government plans to spend about $1,000,000,000 during the next college year for veterans, with $200,000,000 going to tuition and fees; $300,000,000 to housing and $500,000,000 to subsistence. All in all, the GI Bill of Rights adds up to big business.

Wyatt Housing Program

Just how difficult it is to get a giant over-all housing program hitting on all cylinders even when it has popular support is indicated by the fact that another month will pass before the Wyatt subsidies for veterans' housing will be ready for action. In the meantime, what little dent has been made in the need for 2,700,000 homes during 1946-47 has been done by private industry. The delay may have served a useful purpose, however, for when the program was first conceived, planners were thinking in terms of individual single dwellings. Today they talk in terms of housing for 2,700,000 families, instead of merely "homes." This means that rental properties, including low-cost apartments, are not only permitted but favored, in the interest of economy and speed. This decision has been influenced by studies indicating that many veterans prefer this type of housing and are not yet ready for individual home ownership.

Materials Subsidy Program

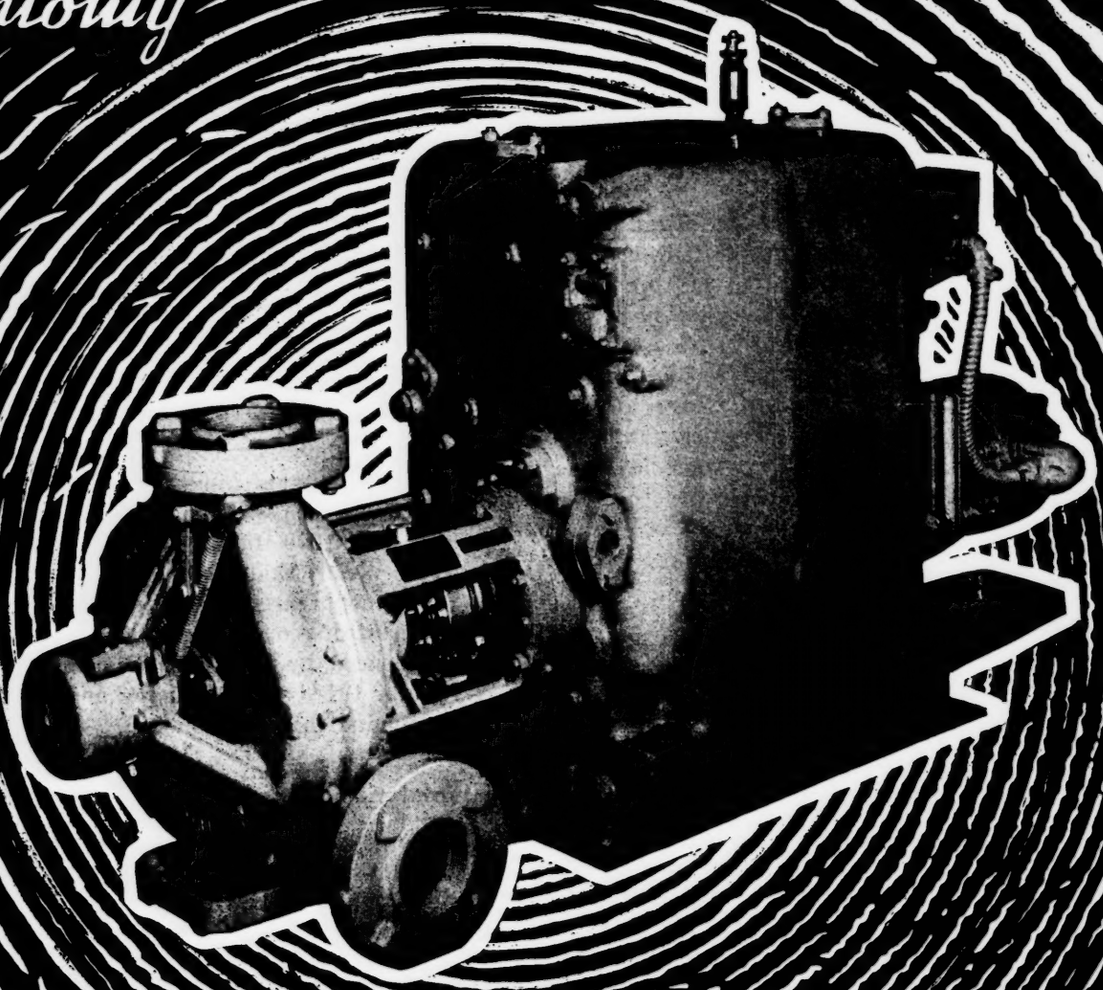
As for the materials subsidy program, approved by Congress, Housing Administrator Wyatt has promised that the industries concerned will be consulted before the programs are announced. Commodity task committees are now busy formulating plans to apply premium payments to specific fields. The task committees are assisted by industrial consultants, and the completed programs are to be submitted to industry advisory committees. No subsidy program has yet reached the final stage. Consultants on brick and softwood plywood have submitted their proposals, while under consideration are programs for roofing, lumber, paper liner for gypsum board, hardwood flooring, pig iron, radiators and plumbing equipment, while other items will probably be added to the list.

Wyatt has announced that the programs will be as flexible as Congressional restrictions will permit; for example, to get plants closed following the war back into operation; to offset increased costs due to overtime operation, such as cost of an extra shift and overtime wage costs; to pay for high-cost operations due to the use of inferior facilities and equipment, use of inferior materials, untrained help, and so on; to take account of costs of modernizing machinery; to stimulate research into new products, and to promote imports, such as logs from Alaska.

After considering all such factors, decision will be

(Concluded on page 100)

Centralized Heating Economy



A RETURN LINE VACUUM PUMP THAT CUTS HEATING COST.

This unusual pump needs no electric current, cutting out greatest item of pump operating expense.

More important, this pump insures absolutely uniform circulation in system. That means continuous steam economy.

Simple, compact, one moving element, no wearing parts, no internal lubrication. Bulletin No. 203 gives the facts. Your copy is waiting.

THE NASH ENGINEERING COMPANY
SOUTH NORWALK, CONNECTICUT, U. S. A.

DUST REMOVAL

CUTS MERCHANDISE LOSSES

Winter condensation is eliminated on this large plate glass front of American Sporting Goods store, St. Louis, by warm air blown down on glass from narrow duct above window.

How a yearly loss of $5,000 in discolored merchandise was avoided through use of dust removal equipment as part of an air conditioning system.

A FORTY-TON air conditioning system, which combines an electronic air cleaner for reducing the soiling of merchandise, is an outstanding feature of the new American Sporting Goods Co. store in St. Louis, Mo.

This air conditioning system was specified in the design of the seven-story building to do two major jobs in addition to ordinary comfort cooling. These are, complete removal of the dust which creates constant markdowns of soiled merchandise up to $5,000 per year average, and, to enhance the attraction of the store by keeping a display window free from condensation.

The remodeled building houses one of the largest sporting goods stores in the country, with five selling and management floors, and two levels for shipping, warehousing and receiving operations. Fluorescent lighting is used throughout.

The system begins with the mixing chamber and coil housing, which instead of being hidden away in the basement or on the roof, is prominently set up on the third floor of the store, separated from the sales floor only by swinging glass doors. Four banks of finned surface cooling coils, the blower, mixing chamber plenum, and a Precipitron dust remover are all housed in a handsome sheet metal enclosure, with windows in each section for creating visitors' interest. The chamber housing and the 40-ton Westinghouse compressor are placed on a tiled floor similar to the rest of the building, and are outstanding for cleanliness and appearance.

The compressor is a hermetically sealed, 8-cylinder unit, using Freon. It is vertically connected through 8-in. risers with a 40-ton evaporative condenser mounted on the building roof. Otherwise, the entire system is located at this one point where it can be demonstrated by store officials to visitors on tour of the store.

The system circulates 16,000 cfm of air, cooled to maintain a temperature of 80F with 50% relative humidity when outside temperatures are 95F with 76% humidity. Due to the box-like construction of the building, with minimum windows and exits, it is possible to recirculate comfortably 80% of the building air, adding 20% fresh air from a rooftop intake during the cycle. There are no stations or remote cooling boosters, merely 20x8 in. ductwork sufficient to distribute cooled air to all floors through either grilles or anemostat type ceiling outlets. Controls for varying the temperature are located on the office level, con-

Grilles in walls and outlets in ceilings are used to convey air to the various floors.

forces the air down over the glass. Return is by means of a grille over the upper left-hand corner of the window. During summer, the same 1-in. duct likewise overcomes a pool of heat caused by 27 direct spotlights set inside the window for "punch lighting".

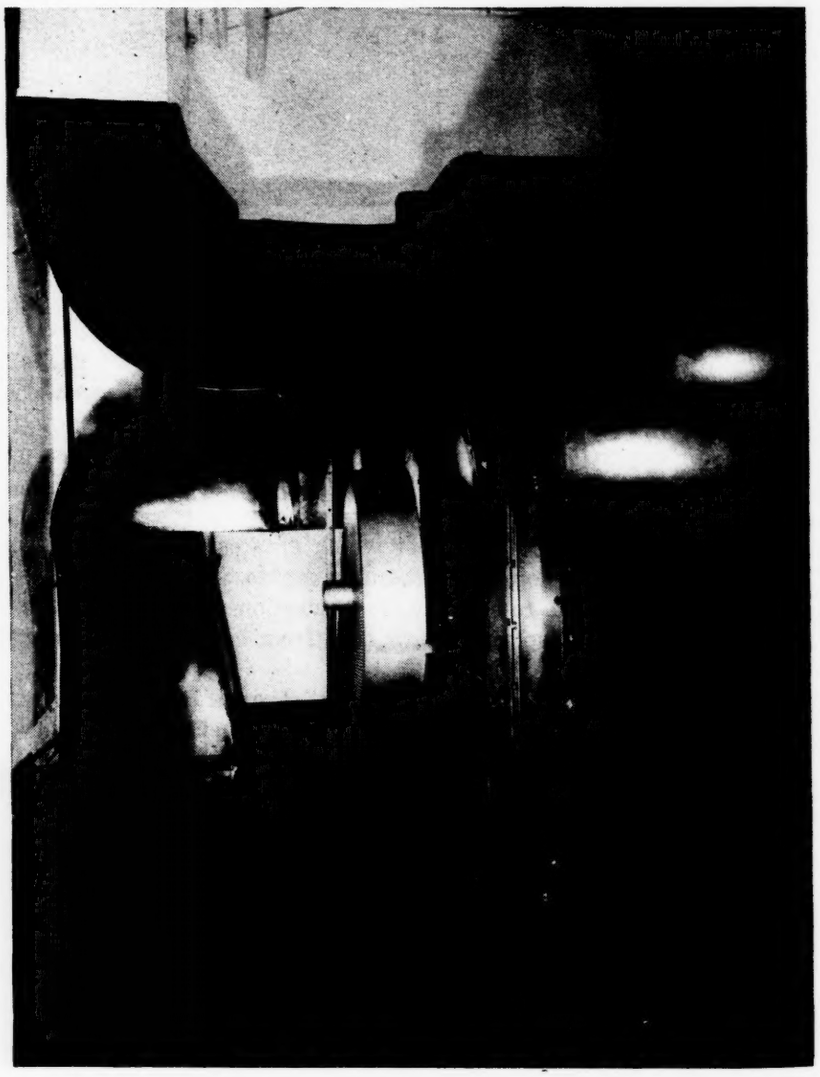
An exterior grille directly over the door outside the windows utilizes b o o s t e d air to blanket the doorway with a stream of warm air in winter, or cool air in summer. Not only does this create a good impression on entering customers, but blows back insects and dust.

The complete system was designed and installed by Natkin & Co., air conditioning and heating engineers, St. Louis County, Mo.

venient to the building manager. The two upper floors, used for storage and shipping, will be cooled until the maximum heat load is reached, and then they will be cut out of the circuit in favor of the selling and management floors.

The Precipitron is located between the return air and outside air cooling coils. To maintain an even static pressure, steel sheet pierced with small holes is set on the outgoing side of the Precipitron. With many sporting goods items subject to quick loss of sales desirability because of dirt, the cleaning unit is paying for itself swiftly, according to store executives. Another immediate advantage is increased value from the lighting system which does not thus have to cope with an atmosphere loaded with dust particles, or because dirt settled on the lamps.

One of the unusual ideas is the handling of air at the store front, which is composed of a large expanse of plate glass without posts or vision-obstructing framework. This, naturally, brings up the problem of moisture condensation in winter. To avoid this condensation a hidden duct 1 in. wide by 10 in. high was furred in, concealed in the canopy over the window interior. The duct runs the full width of the store front. During winter warm, recirculated air is sent to the front windows through a separate duct, where a booster fan picks it up, increases the flow pressure 40%, and



Blower delivers 16,000 cfm to building floors.

Preventing Damage to Ship Cargoes by Ventilation and Dehumidification

JOSEPH LEEMING
Bureau of Foreign and Domestic Commerce

Damage to ship cargoes from changes in temperature during an ocean voyage can be classified as that caused by heat, cold, and condensed moisture. All these types of damage are closely interrelated, one giving rise to the other or two types (as heat and sweat) occurring simultaneously in the same cargo hold. Much of the damage from these causes is preventable by proper stowage, ventilation and dehumidifying. The author reviews the fundamentals, and describes the need for these precautions. The article is abstracted by permission from the author's book "Modern Ship Stowage" published by the Department of Commerce.

A GREAT amount of damage to certain classes of cargo is caused by the excessive heat encountered on long voyages through or into tropical waters. Moderate heat will damage chocolate, lard, hardened oils, cheese, syrups, wine, beer, ale, and similar goods. It will also cause wet or damp hygroscopic cargoes (such as green lumber, pulp and paper, grain, seeds, flower bulbs, dry hides, and most other products of plant or animal origin) to release part of their moisture content into the contacting air or cargo in the form of invisible vapor. Such moisture should be removed from the cargo holds by means of ventilation. Otherwise, this moisture may condense on cold cargo or cold inside surfaces of the ship's structure, or may be absorbed by cool hygroscopic cargo. If it condenses to form sweat, it may damage a large quantity of cargo.

Many of these cargoes which gave much trouble in the past are now carried in refrigerator ships or refrigerated compartments.

Numerous commodities, chiefly of vegetable or animal origin, are subject to spontaneous heating, and when this occurs they are likely to deteriorate or rot. Examples of commodities of this type include nuts, beans, cocoa, and pepper, which are liable to heat, sweat, and deteriorate; fine seeds, which may heat and germinate if too moist; hay and wool, which if damp may cause spontaneous combustion; jute and some other fibers, also oilseeds, corn, oats, rice, and other grains—particularly if shipped in an unripe state—which give off a great deal of moisture with resultant sweating, deterioration, and loss of weight. Also tobacco and oil cake, which become moldy and stale when heated; and copra, jelatong, and gambier, which give off heat and moisture and lose weight. Practically all these commodities, by giving off heat and moisture, may imperil other goods stowed in their vicinity.

Certain precautions may be taken in connection with the stowage of goods of this nature to guard against damage to them or to other goods stowed nearby. Stowage of these commodities, particularly when in bags, in the holds beneath other cargo is to be avoided, since the pressure and insulating effect of the cargo above the bags increases the generation of heat. 'Tween-deck stowage is to be preferred.

Such goods should not be stowed near the engine or boiler room bulkheads. Where such goods are frequently carried, a valuable practice adopted by some companies is to sheath hot bulkheads or to leave a space between bulkhead or ship's side and cargo through which cool air can be circulated.

Goods liable to spontaneous heating should not be stowed near wet goods, since the former will increase the evaporation of the liquid contents of the latter, which in turn will accelerate heating of the first commodity.

Pick out cargo to stow near or next to goods of this class, which is not likely to be damaged by the heat, moisture, or sweat produced by the spontaneous heating cargo.

Wet or damp packages of such commodities as beans and nuts should not be accepted for shipment or else should not be loaded until they have been thoroughly dried out. Wet packages of such goods will inevitably heat and deteriorate during the voyage.

Proper ventilation is essential, and this is discussed later. In addition, however, to stowing goods liable to dangerous heating in the 'tween decks where air circulates more freely than in the holds, circulation of air around this type of cargo should be assisted by

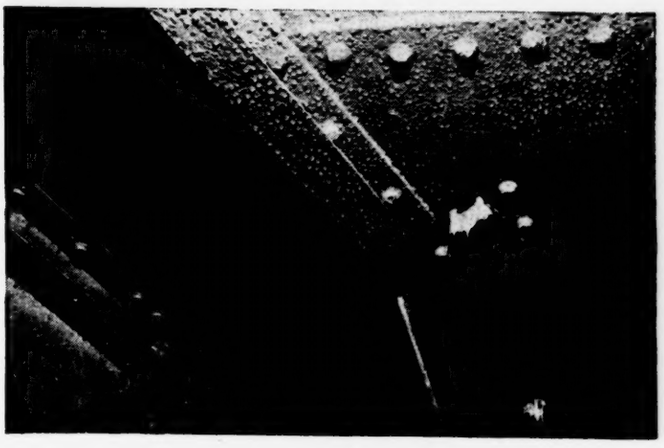


Fig. 1—"Ship sweat" or moisture from air condensing on a cold deckhead.

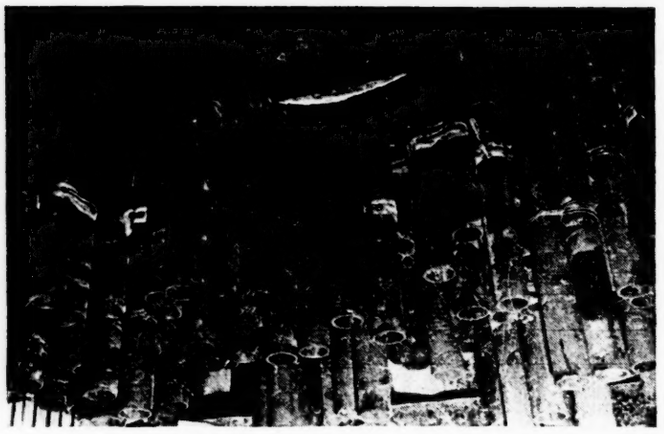


Fig. 2—"Cargo sweat." Moisture from ventilating air condensed on this shipment of black pipe on an intercoastal trip and the pipes became rusty.

allowing ample space between tiers. It is equally necessary that the air can freely leave the cargo compartment—a point frequently overlooked. A continuous air space of at least six inches below the weather deck should be provided.

Damage from Condensed Moisture

Moisture damage or sweat damage probably ruins more cargo each year than any other form of ocean-shipping hazard. This is partly because sweating or moisture condensation is so prevalent in the ordinary vessel's cargo holds and partly because so many commodities are susceptible to damage by moisture. Textile goods are discolored and mildewed, metals and machinery are rusted, foodstuffs of many sorts are rendered unpalatable, fibers and grains are heated and fermented, woods of some kinds are stained, and many minerals and chemicals are dissolved or changed in chemical composition.

Two kinds of sweat are damaging factors—"ship sweat" and "cargo sweat". The former (Fig. 1) is caused largely by some part or parts of the cargo heating and giving off water vapor which condenses on the ship's structure. Cargo sweat (Fig. 2) is formed by the condensation on cold cargo of moisture carried by the air in the ship's holds.

Sources of Trouble in Holds

Factors entering into the formation of sweat are moisture, loss of moisture (as through evaporation), heat, and cold. These causes are closely interrelated and often occur simultaneously in the same hold. Their great danger lies in the fact that they lead readily to other damage, such as spontaneous heating, molding, sprouting, infestation with vermin, crushing, corrosion, tainting, staining, putrefaction, shrinking, and a combination of any of these. Much of this type of damage is preventable, provided the proper steps are taken before, during and after ocean transit by those who are in charge of stowage and of taking care of the cargoes. For this purpose, a clear understanding of the facts involved, including the sources of moisture, heat, and cold in cargo holds, and the principle of condensation, is necessary.

The condition of the cargo regarding the above types of damage depends greatly on two items: The temperature and moisture condition of the cargo at the time of loading; and the temperature and moisture condition of the air with which the cargo comes in contact from the time of loading until the time it is delivered.

Sources of moisture in cargo holds are: Water vapor in atmospheric air; free moisture in cargo, such as rain, snow, ice, salt water, condensation, etc.; hygroscopic moisture in cargo; moisture in containers and packing materials; rain, snow, or salt water entering the hold through vents, hatches, etc.; and leaks in ship's structure, and steam and water piping systems.

Moisture in the cargo holds from one or more of the above sources may be condensed to form sweat on either ship or cargo by the interaction of heat and cold. It should be noted that the materials used for wrapping, packaging, and dunnaging, such as cardboard, kraft paper, dunnage lumber, box shooks, bags,

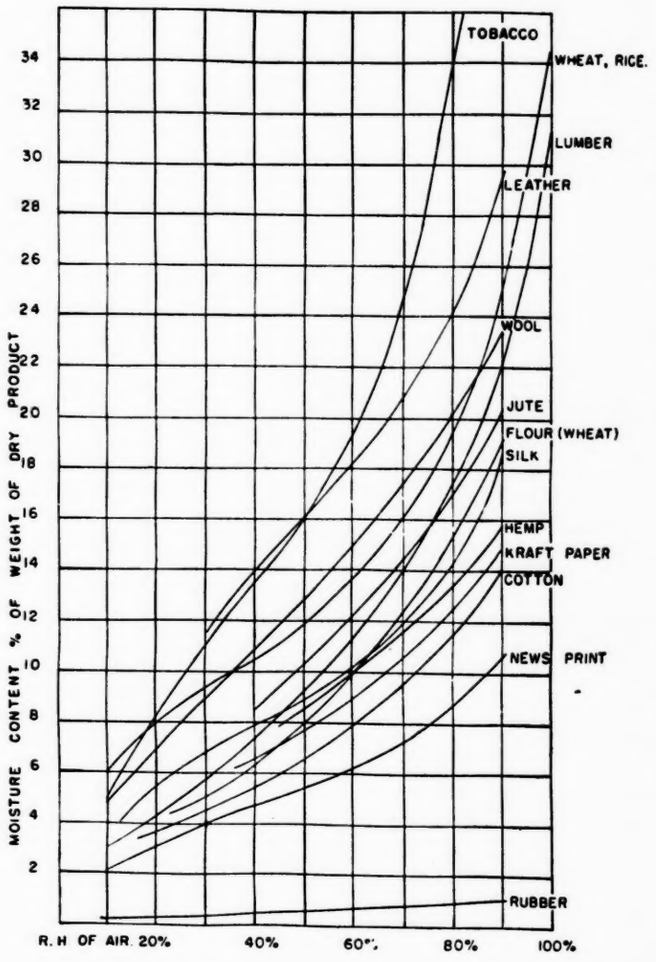


Fig. 3—Moisture equilibrium diagram of commercial products at 75F.

and matting, form a substantial portion of all cargoes and usually contain much moisture.

Sources of heat in a cargo hold are: Sun radiation, warm atmospheric air, and warm sea water; steam plant of ship, including hot pipes, bulkheads, and decks; and cargo loaded hot or heated spontaneously.

Sources of cold in a cargo hold comprise cold atmospheric air, rain, and snow; cold sea water, includ-

ing waves, spray and ice; refrigeration plant, including cold decks, bulkheads, and pipes; and cargo loaded cold.

Free moisture may contact cargo in transit from the manufacturing plant to the ship's cargo hold, by way of processing, intentional wetting with the purpose of increasing the weight, or as a result of rain, snow, sea water or condensation. Such moisture is either visible on the surface or is contained within the capillary spaces and pores of the cargo. In inert goods, such as ore, coke, sand, also cotton, wool, and similar goods, free water causes no direct harm. In all seeds and grain—also hay, dry hides, and most goods of animal or plant origin—free water is absorbed and thus causes a multitude of troubles, such as sprouting, spontaneous heating, and molding. On metallic cargoes, such as canned goods, bundles of black or coated steel plate, pipes, wire, and machinery, free water causes corrosion. On sugar, salt, and cement, free water causes caking. On burlap, tobacco, and lumber products, free water causes stains. Salted hides are an exception, as they are stowed thoroughly wetted with brine and should be kept wet. However, rain, condensation, or sea water will stain them, too.

Free moisture in contact with unsaturated air of like temperature tends to evaporate until the air is saturated, or until all free water is evaporated. The lower the relative humidity of the contacting air, the greater its velocity over the wet surface, and the higher its temperature, the faster the free water will evaporate. Hence, if wet cargo is to be dried, provisions in packing, stowage, and dunnaging have to be made to allow an ample quantity of relatively dry and warm air to come in contact with the cargo. The quantity of free moisture in a cargo hold is greatly variable, but is likely to be in the order of several percent of the total weight of cargo in the hold.

Hygroscopic Moisture in Cargo

A gain or loss of hygroscopic moisture, which is combined with the cargo, often affects its characteristics and may damage it. For example, damp wheat containing 25% or more of moisture will actually sprout. With about 17% moisture it will merely respire and produce heat, water vapor, and carbon dioxide gas. With decreasing moisture content it is more and more dormant, and with less than 12% moisture it can be kept without further precautions in a closed cargo hold, even under varying temperature, for many months without any risk of deterioration or the release or accumulation of harmful amounts of moisture. All seeds respond in a similar manner. Lumber, hides, fibrous goods, paper, and most other hygroscopic goods become tougher and shrink in volume as their content in hygroscopic moisture is reduced. Also mold, infestation with insects, and generation of odors is inhibited in sufficiently dry cargoes.

It follows from the foregoing that a sufficiently dry cargo is always the safest and easiest to carry in ships. Such cargo requires no ventilation at any time, and no special provisions regarding stowage and dunnage.

Hygroscopic moisture in cargo—contrary to free moisture—does not tend to evaporate completely when exposed to an ample amount of unsaturated air. Instead, the moisture content of the cargo affects the relative humidity of the contacting air, and also the relative humidity of the air affects the moisture content of the cargo. The final equilibrium obtained depends on the respective weights of cargo and air involved in the process.

The moisture content of a given product in equilibrium with a given relative humidity is called the "equilibrium moisture content," which is expressed as a percentage of the dry weight of that product. Fig. 3 shows these relations for a number of commercial products at normal temperature. The equilibrium moisture contents shown decrease slightly with higher temperatures and increase slightly with lower temperatures. A complete moisture equilibrium diagram is shown for lumber (and useable for certain other products) in Fig. 4.

Fig. 4 indicates, for example, that a cargo of wheat containing 14% moisture when ventilated with air having more than 70% relative humidity at normal temperature will tend to absorb some moisture from the ventilating air, which is undesirable. On the other hand, if such wheat cargo is ventilated with air having less than 70% relative humidity, it will tend to evaporate some moisture into the ventilating air. These processes are well known in industry, and can also be used on board ship to influence the condition of the cargo.

Fig. 4 also indicates that a relatively dry and warm zone of the wheat cargo, for example, near a warm bulkhead, tends to build up the moisture content of cooler zones of the same wheat, such as those near the cool sides of the ship, a condition which may cause damage to the cool wheat.

Owing to the fact that cargoes are loaded under many conditions, that moisture transfer of the type discussed above is very slow, and that the temperature through which a ship is traveling is always changing,

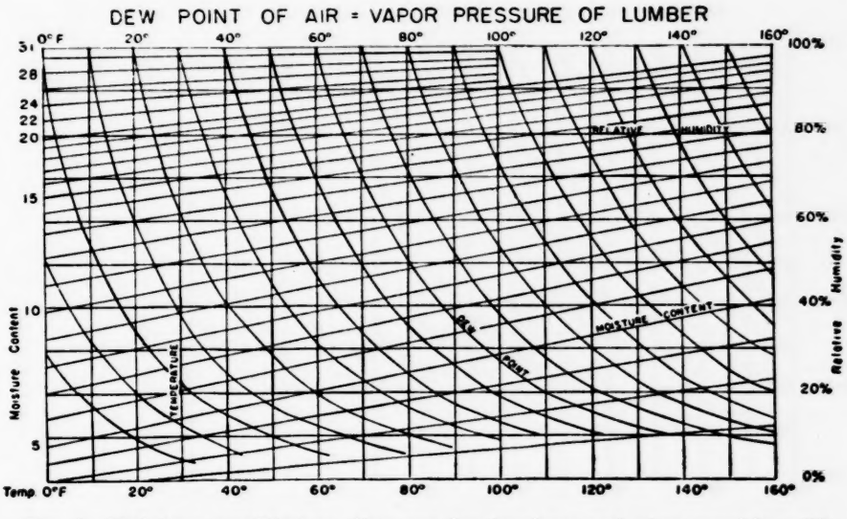


Fig. 4—Moisture equilibrium diagram for lumber, and also useable with reasonable accuracy for wheat, rice, corn, wool and jute.

a never-ending exchange of moisture is taking place in all cargo holds, between cargoes and contacting air.

Protection Against Sweat

Methods that may be employed to eliminate or reduce cargo damage caused by sweat include: Conditioning of cargo prior to shipments; care in stowage and dunnaging; proper ventilation; and use of mechanical dehumidifying systems.

Conditioning Before Shipment

Many products, chiefly agricultural, are likely to heat spontaneously and to deteriorate when they contain excessive moisture. Most of these goods, *when efficiently dry*, could be shipped in a tightly sealed cargo space on long ocean voyages and would not need any ventilation or care whatever. The presence of hot or cold bulkheads or changes in the outside air would not cause a dangerous transfer of moisture under such conditions. Little, if any, moisture would tend to evaporate from the cargo and any excessive moisture in the air of the closed hold would be absorbed by the cargo. Therefore, no condensation could occur in cold weather on the cold metal of the ship.

A logical procedure would be, therefore, to dry all goods likely to heat spontaneously below their safe moisture limits and then carry them to their destination without further protective measures.

The U. S. Department of Agriculture and several American steamship companies have made large-scale experiments along these lines with grain and other cargoes, proving that the above statements are correct. In view of this experience, many trades have recognized such procedure as one of the best (if not the only) solution of their troubles, and numerous drying plants for grain, seeds, nuts, and numerous other goods have been built and are being developed in all parts of the world.

The canning industry has had a comparable experience. Experiments made in 1932 by the Forest Products Laboratory, indicated that the box shooks of which the wooden box containers were made should contain less than 17% of moisture in order to prevent the rusting of tin cans during long voyages.

Fig. 5—Bulk corn near this shaft alley ventilator was kept cool. Hence, much moisture originating from heated zone of the bulk cargo was absorbed by the cool grain and condensed on the vent shaft. Much grain was spoiled.

Stowage

Proper stowage and dunnaging are necessary if the full benefits of proper ventilation are to be secured in reducing or eliminating the formation of sweat. All cargo that requires treatment in the hold because of its condition or because of the presence of sources of moisture, heat, or cold, must be accessible to ventilation. It is, therefore, very important that the cargo be stowed and dunnaged in such a manner that air can freely enter the hold and intimately contact the cargo. It is equally necessary that the air can freely leave the hold after doing its work—a fact which is often overlooked in stowage.

Wet, hot, and cold cargo should be stowed with ample dunnage between tiers. The spaces thus created should have access, supply, and exhaust, to the main air streams through the hold by leaving space at two ends of the parcels.

Ventilation

Moisture has been shown to be the most important source of trouble in cargo and in air. The moisture in cargo can be controlled successfully by air of desirable condition. Ordinarily, on most ocean routes and in dry weather, the temperature and relative humidity of the outside air are satisfactory. An ample supply of such air should be distributed through the holds so that the areas of moisture, heat, and cold are well aired. The term "ample supply" means at least two complete changes of air per hour calculated for the empty cargo hold.

"Cold" goods, such as steel products and canned goods, loaded at a northern port should not be ventilated with warm, humid air. The present common practice of continuously ventilating steel and canned goods without regard to the dew point of the air or the temperature of the cargo should be discontinued. As long as the temperature of the cargo is below the dew point of the atmosphere, the admission of warm moist air into the hold must necessarily cause condensation on the cold metal cargo. After the cargo has become warmer than the atmospheric dew point, the admission of warm moist air into the hold will not produce condensation.

When a ship from the tropics with its hold filled with warm, moist air enters cold water or cold weather suddenly, condensation from the warm air may form on the cold metal surfaces in the cargo holds. Such condensation may form on the beams and underside of the deck plates, even though the temperature of the cargo is about the dew point of the atmosphere. This condensation may be evaporated by ventilation without harm to the cargo, provided the ventilating air is not saturated with moisture and has a dew point lower than the temperature of the metal.

On vessels proceeding from a cold to a warm region the temperature of the cargo should be raised above the dew point prevailing at the port of discharge to which the ship is traveling, so that the cargo will not

be damaged by sweat when unloaded on the dock. This is accomplished by providing an ample supply of warm, low dew point air over the surface and through the body of a block of cold cargo. Atmospheric air, with a dew point lower than the temperature of the cargo, is frequently available for this purpose and can be admitted through the ship's ventilators; or such air may be provided by a dehumidifying system, as explained below. If such air is not available, the hold should be kept sealed tightly to the outside air and natural transfer of heat through hull air and cargo will then slowly warm up the cargo, as the ship travels though hot climates and warm seas.

It should be noted that cold decks and bulkheads near refrigerated spaces are undesirable, as they tend to keep the cargo next to them cool. Good insulation and dunnage will reduce this source of trouble.

Improper Ventilation

Two examples of improper ventilation are cited below to further clarify the principles involved in preventing condensation.

In one very typical case, heavy losses caused by sweat occurred to canned goods shipped from Vancouver to Australia. In the investigation to determine the cause of the damage it was found that the master ventilated the cargo compartments continuously during the entire voyage, believing this was a certain method of preventing sweat damage to canned goods. From a study of the case it became evident that he literally poured warm, moist air on cold canned goods—with the inevitable result that condensation formed.

In another case, a lower hold of a ship was filled with pitchpine logs which were loaded wet from rafts. It was assumed that these wet logs stowed separately in the lower hold would not harm other cargo. As the vessel proceeded through the tropics, however, the water in the logs evaporated, and the vapor rose to the 'tween decks and condensed on the under side of the deck. From here it ran down on top of a large consignment of canned goods and rusted the cans and loosened the labels, resulting in a heavy claim. Marine surveyors retained in connection with the damage gave it as their opinion that the damage could have been prevented by permitting the vapor to rise through an open hatch instead of condensing under the deck.

Dehumidifying

One type of dehumidifying equipment (Cargocaire system) has been installed on many U. S. cargo vessels. This system reduces the dew point of air in ships' holds by dehumidification to a point at which ship sweat and cargo sweat cannot occur.

The Cargocaire installation consists of three units: (1) the dehumidifying unit, employing silica-gel as the adsorbent, located in or near the engine room, which produces large volumes of very dry air; (2) the ventilating and recirculating system, consisting of blower and ducts for each hold for ventilating with outside air or recirculating the inside air. Dry air from the dehumidifying unit is mixed with this recirculating stream to displace the moist air in the hold; (3) the instrumentation, which gives the deck officers

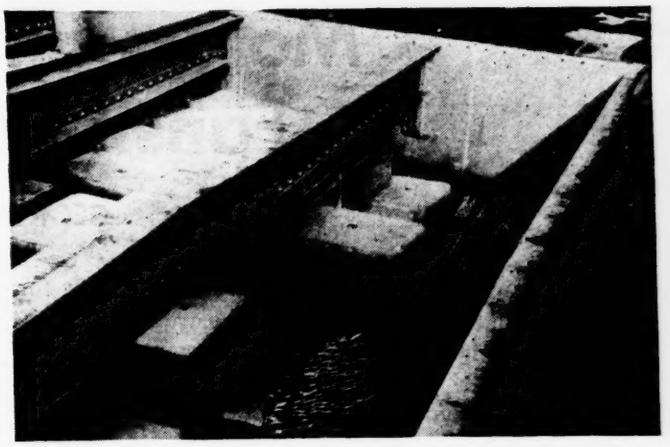


Fig. 6—Tobacco shipped in winter shows no trace of dripping condensation after proper care and treatment with a dehumidifying system. The beams are covered with dust.

knowledge at all times of the air conditions outside the ship. A quick comparison tells the officers when to change the cargo-conditioning to anticipate sweat-forming weather conditions.

The ventilating and recirculating system consists of duplicate duct systems, one supply and one exhaust, on the forward and after bulkheads of each hold. Each has a single mushroom ventilator above a deckhouse, dampers, an axial-flow fan, a downcomer from the fan, and thwartship ducts at the top of each compartment to lead the air past the heavy girders, which may stop air flow when cargo is tightly stowed.

This system provides thorough recirculation of air in each hold, independently of weather conditions and with or without the addition of dry air. It also provides ventilation with outside air alone, when it is dry enough, and with outside air mixed with treated air. Owing to the fact that dry, fresh air is continuously injected into the recirculating air stream, the same amount of air is displaced from the holds carrying with it excessive moisture, odors, and gases. In this manner, the freshness of the air in the holds and the dew point can be controlled without interference from wind, weather, or atmospheric conditions.

In actual operation, when the outside temperature has a sufficiently low humidity or dew point, it may be circulated in large volumes through the holds. When, however, the dew point outside rises about that in the holds or above the temperatures expected to be encountered within the next few days or at the port of discharge, the outside air is excluded and treated, and dehumidified air is circulated through the holds.

No attempt is made to heat or cool the holds, as the dew point of the air is independent of temperature changes above it, and depends entirely upon moisture content. It would also be impractical to attempt artificial heating or cooling of the holds, as the system is designed for uninsulated holds. Warming of cold cargo is accomplished, however, by the vigorous recirculation of air in each hold—thus borrowing heat from hot decks and warm ocean currents. This is often desirable, so that cargoes can be discharged in a wet, humid climate where the dew point is high. Unless warmed, the cargo might be dry in the hold but start to sweat after discharge.

Motors and Drives for Fans and Blowers

GEORGE H. HALL

THE size, speed and capacity of a fan or blower for any ventilating system having been decided upon, the question arises as to what capacity and type of motor equipment will be required for its operation. Upon this will depend the operation cost of the system. For the proper consideration of the power requirements, there are certain fundamental principles which must be taken into consideration:

(1) The capacity of a fan or blower varies directly as the speed at which it is run.

(2) The velocity of the air discharged varies as the speed or capacity.

(3) The pressure of the air discharged varies as the square of the speed.

(4) Speed and capacity of a fan or blower vary with the square root of the pressure.

(5) Horsepower to drive varies directly as the cube of the speed or capacity.

These physical fan laws apply to all types of fans with sufficient accuracy for all practical purposes so long as the air conditions, that is, temperature, humidity and weight, remain unchanged. They do not apply accurately when air conditions change. At constant capacity and speed, the horsepower and pressure will vary directly as the density of the air, and approximately inversely as the absolute temperature.

As an example, if the temperature of the air is increased from 50F to 550F, the required horsepower to maintain speed and capacity will be cut approximately in half. The basic formula for the required horsepower is:

$$\text{Horsepower} = \frac{\text{cfm} \times \text{total pressure}}{6356 \times \text{mechanical efficiency}}$$

$$\text{Then, Mechanical efficiency} = \frac{\text{cfm} \times \text{total pressure}}{6356 \times \text{Hp}}$$

The total pressure produced by a fan is the rise of pressure from the fan inlet to the fan outlet as measured by two impact tubes, one in the fan inlet duct and the other in the fan discharge duct. Where there is no inlet duct, the total pressure on the inlet side is taken as 0. The total pressure, in inches of water, is referred to as P_t.

The velocity pressure (referred to as P_v) is the pressure corresponding to the average determination from the volume of air flow at the fan outlet area.

The static pressure P_s is the total pressure diminished by the velocity pressure.

Although the foregoing principles apply to either centrifugal or propeller types of fans, there is considerable difference in the mechanical construction of the respective types, as well as in the class of service for which they are suited. The propeller fan is designed for free or low pressure delivery and is not employed for static pressure of any amount. It is more generally used for exhausting the air from a room and discharging into open air. The centrifugal fan, or blower, is designed for use where a static pressure is desired and is used for the delivery of air, under pressure, in the ventilation of a room, chamber or building, as well as for a complete ventilating system.

The type of blade with which the fan runner is equipped will depend largely upon the service for which the fan is intended. Blades may have the forward, backward or partial backward curve. The slow speed fan has blades tipped forward in the direction of rotation. Its maximium efficiency is at the point of maximum static pressure. Besides being the least expensive in construction, it is also less expensive in operation because of its low speed.

When the blades are curved backward in direction it becomes a high speed fan which operates about two or two and a half times as fast as the fan with forward curved blades. It is more expensive in construction, occupies more space, and is used for a desired maximum power load. The full-backward, multiblade fan has fewer blades than the forward.

A "partial backward" blade fan has the following characteristics:

Blades are slightly deeper and the materials of construction slightly heavier than those of the forward curved construction; blades are tipped backward in direction of rotation; the high speed fan is operated at about twice the speed of the regular forward curved unit. In characteristics, this type of fan is more like the forward curved fan and this type is frequently employed in ventilating and air conditioning work as

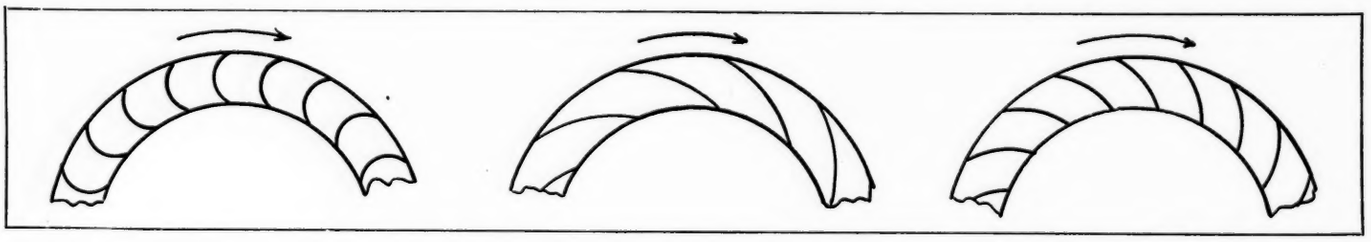


Fig. 1—Types of blades used in multi-blade centrifugal blowers. Left to right, forward curved blades; backward curved blades; partial backward curved blades.

it is often practical to direct connect it to the driving motor. Due to its higher speed, it is usually advisable to use a fan one or two sizes larger than the forward curved fan.

Motors

Ventilating equipment may, of course, be operated on either direct or alternating current but for the majority of present-day installations, alternating current is available and is preferable as adding to the simplicity of operation and reduction in cost of installation.

Formerly it was considered that an adjustable control speed was necessary but present-day practice, if any speed adjustment is required, is to provide only for two speeds, high and low. This means simplicity of control and, when the other elements of the system are accurately estimated, a perfectly satisfactory equipment results. For ventilation, the high speed, and consequently the larger volume of air, may be used in warm weather when the demand for fresh air is greatest and, in cold weather, the slow speed will provide sufficient air for most conditions. When employed in connection with heating apparatus, such as stokers, the reverse conditions obtain and the fan is run at high speed in cold weather, when the greatest amount of forced draft is required, and the slow speed in warm weather when but little forced draft is involved.

Table 1. Output of Four-speed, Two-winding, Multi-speed, Squirrel-cage Induction Motors.

Motor has variable torque characteristics.
X represents the nominal rating of the motor.

	1800 rpm	1200 rpm	900 rpm	600 rpm	450 rpm
Hp Output of Motor	X	.44X	.25X	.11X	
		X	.56X	.25X	.14X

In the early days of the use of motor-driven ventilating equipment, direct-current motors were selected to suit the speed of the fan and direct-connection of fan and motor employed. This meant motors which were to a greater or less extent special and this practice has been largely abandoned in favor of the alternating-current drive or direct-current motors having speeds to correspond with standard speeds of alternating-current motors.

Where single-phase current only is available, almost any of the standard types are suitable but preference should be given to the capacitor motor because of its quiet operation. The capacity of the single-phase motor is generally limited to about 5 hp and is undesirable for any drive large enough to constitute an element of a ventilating system.

For direct current, shunt wound motors are usually used especially when adjustable speed is needed. Speed adjustment may be obtained by field control but the motor must be so constructed as to give the needed horsepower at the maximum speed with the weakened field. Speed reduction may also be secured by the insertion of resistance in the armature circuit which will require the use of fan resistance in the controller and, except for a limited reduction, will give poor speed regulation.

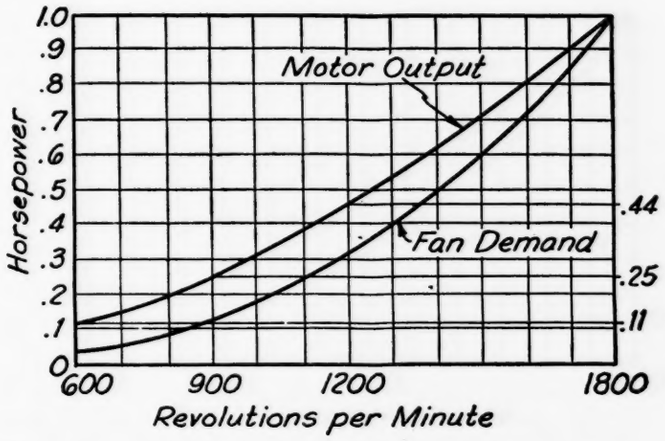


Fig. 2—Graphic comparison of the demand of a fan or blower, and the output of a multi-speed motor with variable torque characteristics.

At the present time, the majority of ventilating and exhaust installations are operated on two or three-phase current and, while a wound-rotor motor is sometimes used when speed adjustment is needed, it is not entirely satisfactory because the speed of such motors varies inversely with the load and, like the armature-controlled direct-current motor, the speed adjustment is not very dependable on account of poor speed regulation.

The best motor for fan and blower operation on alternating-current is the squirrel-cage, when constant

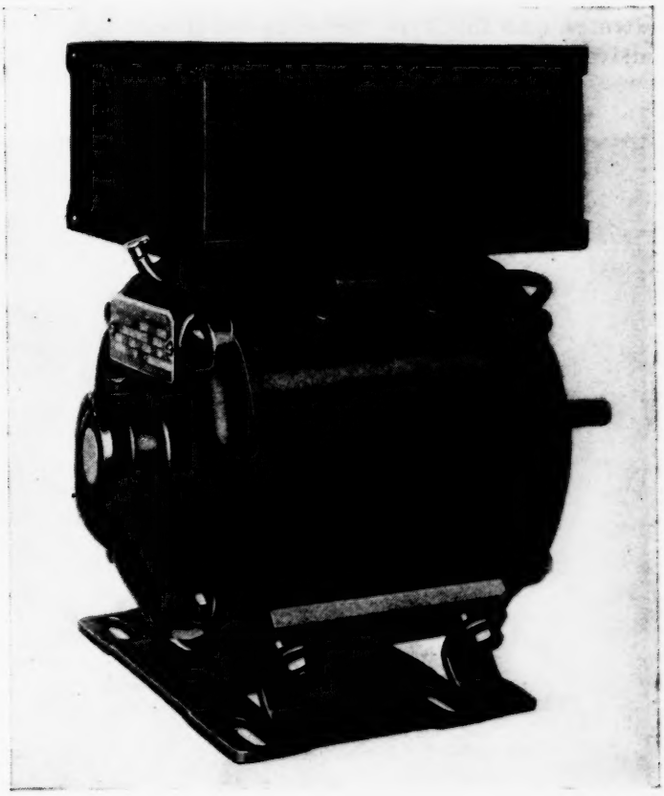


Fig. 3—Typical capacitor motor for ventilating applications. Motor is designed for quiet operation and is shown mounted on a resilient base. Wagner Electric Corp.

speed is acceptable. Such conditions are often the case. If a speed adjustment is needed, it may be obtained by the use of one of the types of mechanically adjustable speed drives.

A far better method of speed adjustment on alternating-current lies in the employment of the multispeed motor. The speed of such a motor is adjusted by changing the pole grouping so that one, two, three or four speeds may be obtained. Usually, two speeds are sufficient and the type of winding should be that which gives a variable torque. Such a motor has an output which is maximum at its highest speed, and varies with the speed reduction. This type of motor will always have sufficient torque for driving the fan provided the motor has sufficient power at its maximum speed. The varying torque motor having two speeds and employing a single winding is most generally used for ventilation. As it has consequent pole winding, its speed range is always 2:1, that is from maximum to minimum. The speed is of course dependent upon the pole selection but the power output varies as the cube of the speed. Therefore any motor chosen for the power requirement at maximum speed will always deliver sufficient power at reduced speed.

In the use of the wound-rotor motor, the speed is controlled by the introduction of resistance into the secondary circuit. While the multispeed may sometimes cost more than the wound-rotor motor, the controller will be cheaper than the comparatively simple pole-changing switch that is used with the multispeed outfit.

For purpose of comparison, Table 1 or Fig. 2 shows the power requirement of a fan and the power output of a multispeed motor having varying torque characteristics. Such a comparative curve clearly demonstrates that this type motor is better suited for fan drive than the multispeed motor having either constant horsepower or constant torque outputs. The output of the varying torque type provides the closest parallel to the power demand of the fan.

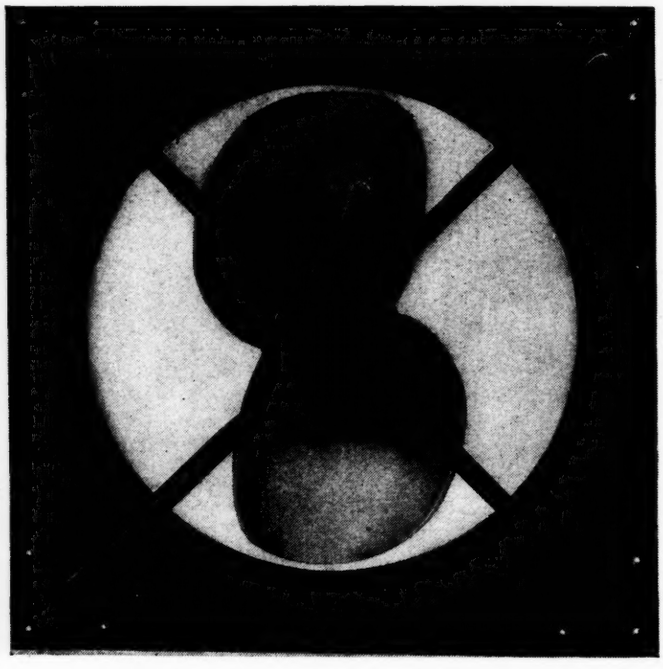


Fig. 4—Typical two-blade motor driven propeller fan. A similar construction is employed for multi-blade fans. American Blower Corp.

Squirrel-cage motors are constructed in six different forms (A,B,C,D,E and F) based upon their starting and running characteristics. For driving fans the class known as F is particularly suitable since it permits starting by placing the motor directly across the line and it affords low starting torque which is suited to fan requirements. The slip of this type of motor at rated load is comparatively low.

Due to the consistent reduction of the power demand by any reduction of speed, that is, the power demand lessening as the cube of the speed, there is but little danger of involving an overload provided, however, the motor selected has sufficient power to drive the equipment at the maximum speed at which it will be operated. Nevertheless, any control equipment that is supplied with a ventilating outfit should be provided with an overload device to protect the motor in case of accidental overloading that might be caused by the motor becoming blocked or stalled.

In this matter of overloads, consideration should be given to the service factor. This factor is applied to general-purpose motors and is a multiplier of the normal rating which indicates the maximum permissible rating for which the motor may be used without injury. No temperature guarantees, such as were formerly given, are now employed. However, the service factor, which say is 1.15, means that the motor will carry 15% overload, without injury when the motor is operated on rated voltage. It is true that since the

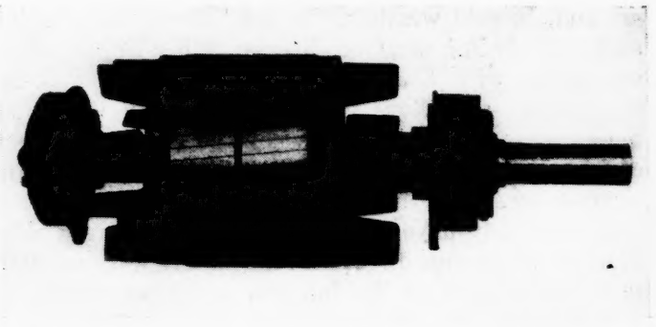


Fig. 5—Squirrel-cage rotor with bars skewed to secure quiet operation. Reliance Electric & Eng. Co.

service to which ventilating apparatus is applied offers but little chance for overloading, except in emergency cases, controllers and starters should nevertheless be provided with overload protective devices although they are seldom operated. The momentary overloads that are often encountered by motors in general industrial practice are far less likely to be met in ventilating practice than in almost any other class of motor application. What is more likely to occur is an overload caused by the selection of a motor of insufficient horsepower so that it is continuously overloaded unless protected by an inverse time device which releases the current after a continuous overload of a capacity which would result in damage to the motor windings if too long sustained.

The ideal drive for a fan or blower is accomplished

either by mounting the fan blade directly upon the motor shaft or by direct coupling of the fan and motor shafts. For direct-current motors, this is the most satisfactory method of drive as the motor may be designed and constructed for any speed needed to suit the fan. With the adoption of alternating-current drive this becomes infeasible in most cases since the fan speed is seldom suited to the synchronous speed of the motor (900, 1200 or 1800 rpm) and some form of accommodating the motor speed to that of the fan or blower is demanded.

Belt drive, using ordinary flat belts, is of course the simplest drive. By properly proportioning the size of the driving and the driven pulleys, any speed may be attained. This drive has the objection of some noise, due to slapping of the belts and indefinite slipping. It has been largely replaced by the use of the V-belt

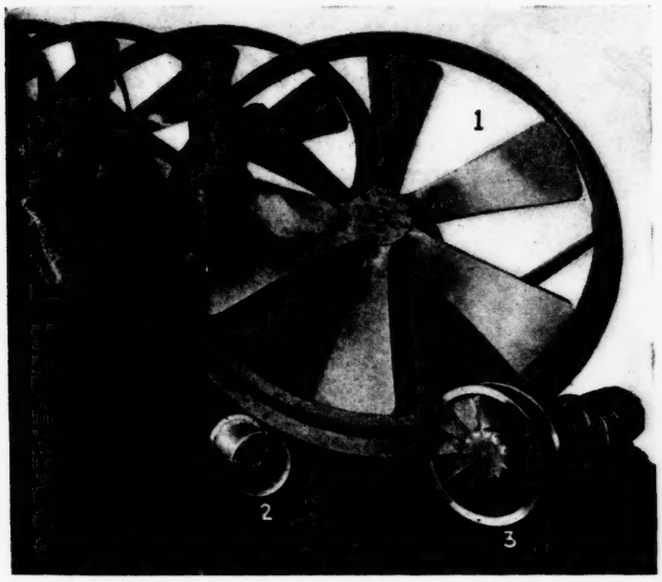


Fig. C—Examples of Fan Design. 1. Airfoil section, axial flow fans with 48 in. dia. propellers powered by 10 hp motors to move 43,400 cfm. 2. A 2-blade design for ventilation of electrical equipment in a large bomber. It operates at 7,600 rpm and has a blade diameter of 7.25 in. 3. A 12-blade unit of the extension shaft type capable of handling high temperature air or corrosive fumes.

drive which may now be considered as practically standard practice. While the sheaves as used in this type of drive are usually of prefixed diameters, there are forms of V-drives in which the respective diameters of driving and driven sheaves may be adjusted in order to obtain desired driving speeds. This may be done manually or, with some types, it is automatically accomplished as the motor is moved on its base to tighten the tension of the belt.

While gear-drive is sometimes employed, unless the gears are of rawhide or some similar resilient material, they are apt to generate noise. Therefore, this type transmission is not often used.

Noise elimination is one that has received considerable attention in connection with ventilating equipment as a small volume of noise may render any ventilating equipment unsatisfactory when the system is used in public places such as auditoriums, theatres,

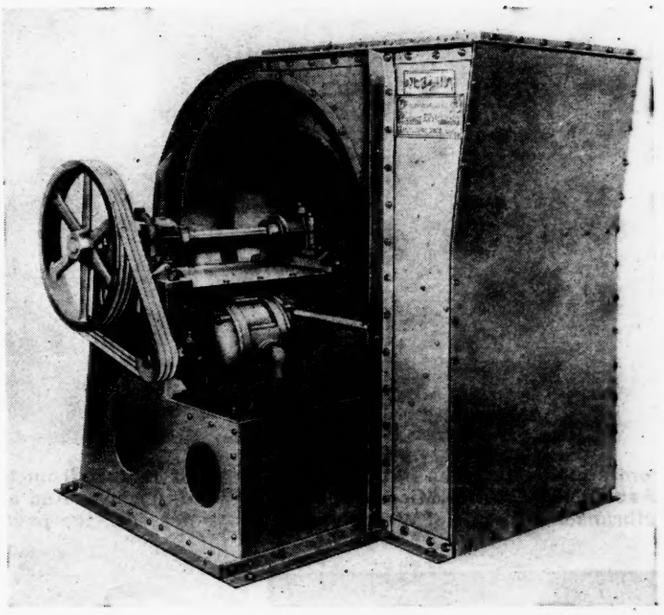


Fig. 7—V-belt drive to ventilating blower. Allis-Chalmers Mfg. Co.

school rooms, etc. Also in private residences, doctors' offices, operating rooms and similar situations where disturbing noises are most objectionable. There are three principal kinds of ventilation noises which must be carefully avoided to insure a satisfactory installation. These are motor noises, transmission noises, and fan noises.

The motor noises are successfully eliminated by motors of special construction which involves the use of skewed rotor bars, resilient mounting of frames and bearings, and special testing in a sound-proof room to assure the manufacturers that they are warranted in the use of the special nameplate reading, "tested and constructed especially for fan operation." Since the development of the sound meter, it became the accepted practice for the engineer to specify the maximum decibels of noise that will be allowed in any particular installation. As this may be accurately measured, any difference in the opinions of the engineer and the equipment manufacturer as to whether the operation is within the decibel range is avoided.

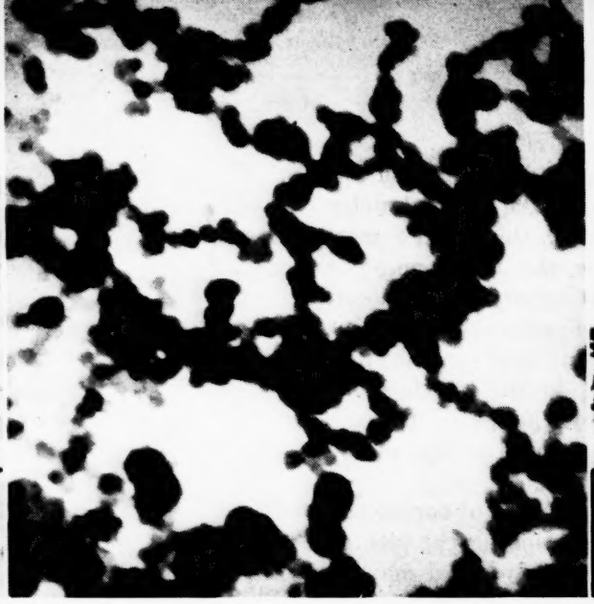
The method of mounting the motor and fan has a great influence on the noise of the equipment. Quieting motor bases have been developed in which the fan and the motor are both carried on resilient supports.

The noise in a fan is due primarily to the velocity of the air passing through it. In some cases there may also be noises radiated from the panels or bearings but the principal cause is due to vibration of the motor, rotor, and the air velocity. Aside from the purely mechanical vibrations, the speed of the fan contributes little to the nuisance problem. The volume of air and its velocity are the prime factors and of course, the higher the pressure, the higher must be the air velocity.

Since the backward curved blade fans have lower air velocity for a given pressure than the forward curved blade fans, they are usually quieter when operating.

Likewise, axial flow fans that are well stream lined and of good efficiency are quieter than those that produce more turbulence.

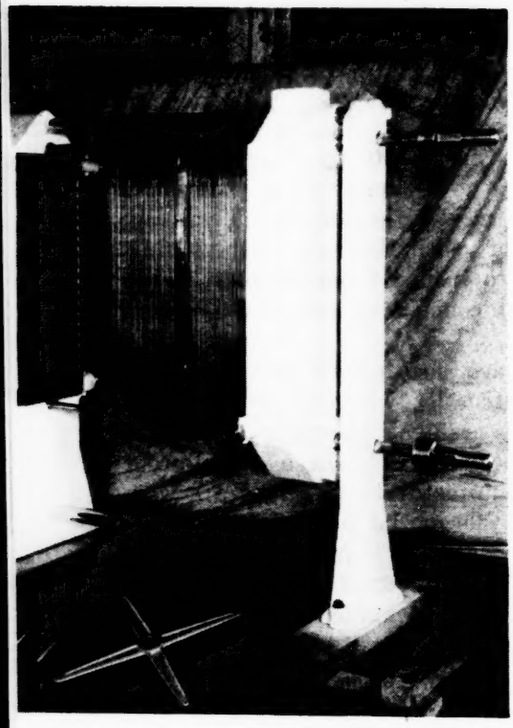
Smoke from a cigarette looks like this when magnified about 10,000 times. Micrographs are by Drs. Gulbransen & Phelps of Westinghouse.



This is dust from the air we breathe electrically precipitated and magnified some 16,000 times with the powerful electron microscope.

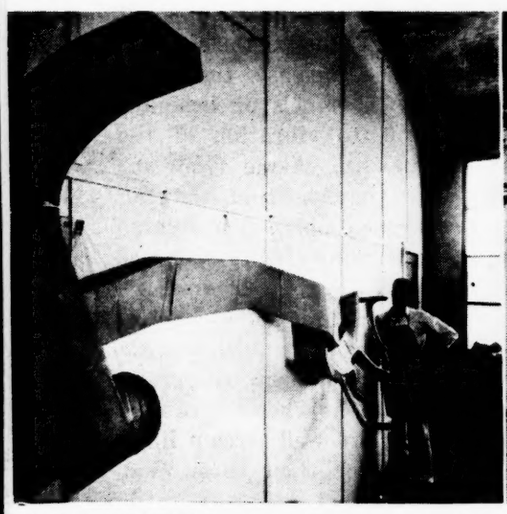
Particle from preceding micrograph was s
gled out and magnified 6,000 times. Actu
length is about three ten-thousandths inc

Picture Paragraphs

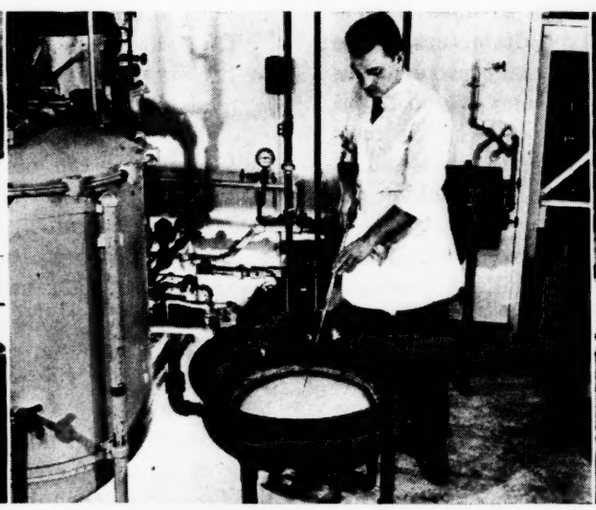


ligh temperature-short time pasteurization of
nilk is accomplished by York Corporation's
tainless steel plate heat exchanger which
ses hot water and milk-to-milk generation
n raising milk to 161.5F for sixteen seconds.

John R. Bergan, Minneapolis-Honeywell Eastern sales manager, talks to a class of hea
ing contractors in Philadelphia where Honeywell and Bryant Air Conditioning Co. hav
launched a new merchandising plan for Moduflow which includes training of dealers an
contractors. Only recognized outlets will handle product. As training progresses, ne
outlets will be encouraged to participate. Above is part of a three-day service forum



An assembled Fiberglas-reinforced plastic aircraft hot air duct for which Owens-Corning claim unusual tensile and shaping properties.



Ingredients for cathode ray tube screen stirred in glass lined steam heated kettle in North American Philips phosphor laboratory.

Ultraviolet lamp cabinet made by Electro
Engineering, Inc., Spokane, sterilizes p
ceries in 30 seconds at the cashier's coun

Panel Heat Flow and its Design Considerations

R. G. VANDERWEIL
Project Engineer, Chase Brass & Copper Co., Waterbury, Conn.

This is the last in Mr. Vanderweil's series of seven articles on the theory and design of radiant or panel heating. As a supplement to the series the author will try to answer questions on this subject sent in by readers.

THE flow pattern of heat was discussed in the May article of this series. To derive a method of computation for heating panels, this flow pattern had to be expressed by mathematical equations. To simplify the layout of heating coils—that is, the selection of tube diameter, tube distance, and mean water temperature, a graphical solution to these equations was derived.

Fig. 1 shows the flow pattern of heat in a panel section one tube wide. As in previous figures, the lines of constant temperature, isotherms, encircle the tubes, and the heat flow lines, with their origin at the tube, flow outward to both panel surfaces. The figure includes the lower and upper boundary layers and the panel structure proper. This structure is shown as a body of constant conductivity k_a and its equivalent thickness was derived from the actual multi-layer structure as was shown in Fig. 1 of the preceding article.

Actually, the designer will not have to compute the equivalent thickness because this was included in the final design graphs. Fig. 2 shows a typical design graph for a ceiling panel with coils embedded in the gypsum plaster of a frame structure such as was considered for the sample calculation (Fig. 14, Page 109, HEATING AND VENTILATING, October, 1945).

From the heat flow pattern, Fig. 1, the final graphs were derived as follows: (1) The actual panel was replaced by an equivalent panel of constant conductivity. (2) Equations for the temperature field shown in Fig. 1 were set up. (3) Boundary conditions were substituted—this is, the temperatures of the tube surface and at the upper and lower equivalent panel surfaces—the temperatures of the rooms below and above. (4) Finally the maximum and minimum temperatures of the actual panel surface were computed.

$$t_{b\max} = \alpha\left[\log_e\left(\sin h\frac{\pi a}{d}\right) - \log_e\left(\sin h\frac{\pi(2A-a)}{d}\right)\right] + \beta a + \gamma$$

$$t_{b\min} = \alpha\left[\log_e\left(\cos h\frac{\pi a}{d}\right) - \log_e\left(\cos h\frac{\pi(2A'-a)}{d}\right)\right] + \beta a + \gamma$$

$$t_{b\max} = \alpha\left[\log_e\left(\sin h\frac{\pi b}{d}\right) - \log_e\left(\sin h\frac{\pi(2A+b)}{d}\right)\right] - \beta b + \gamma$$

$$t_{b\min} = \alpha\left[\log_e\left(\cos h\frac{\pi b}{d}\right) - \log_e\left(\cos h\frac{\pi(2A+b)}{d}\right)\right] - \beta b + \gamma$$

Where $A' = EA$ and α, β, γ are —

$$\alpha = \frac{1}{\Delta}\left[A\,(t_w - t_o) + B\,(t_w - t)\right]$$

$$\beta = \frac{1}{\Delta}\left[\theta_o\,(r, O)\,(t - t_o) + \theta_o\,(O, -B)\,(t_w - t)\right]$$

$$\gamma = \frac{1}{\Delta}\left[A\theta_o\,(r, O)\,t_o + B\theta_o\,(r, O)\,t - A\theta_o\,(O, -B)\,t_w\right]$$

If $\Delta = (A + B)\,\theta_o\,(r, O) - A\theta_o\,(O, -B)$

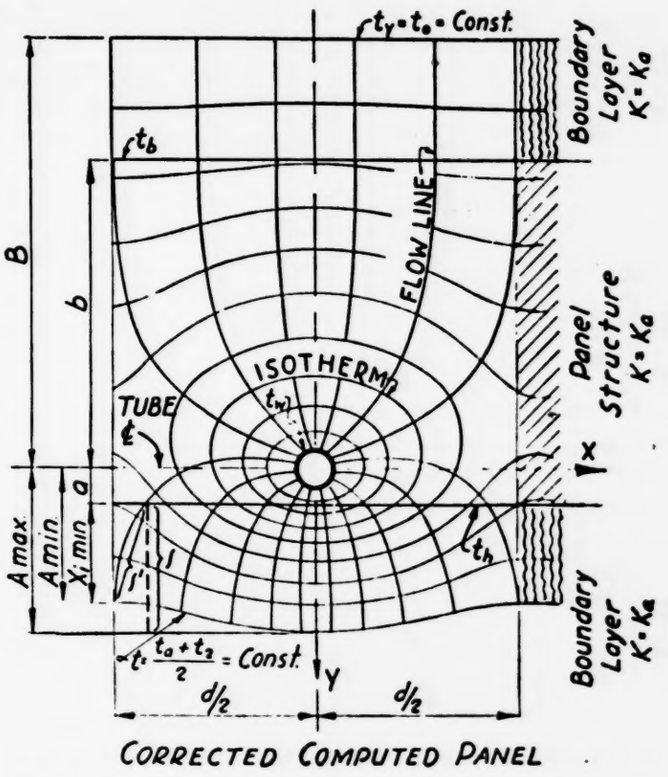


Fig. 1. How heat flows radially from the tube circumference through the panel and the two boundary layers to the room below and above. Influence of one tube only is illustrated.

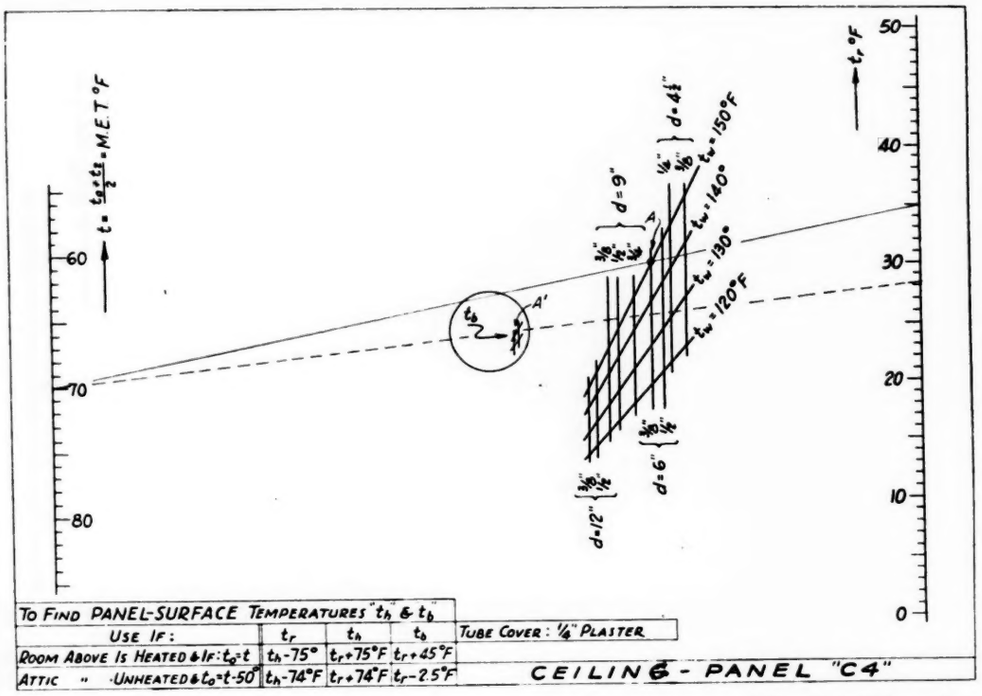


Fig. 2. Variables required to design a radiant heating coil. Room temperature is left scale; reference temperature for panel surface right scale. Scale is designed to give both ceiling and floor temperature for conditions where the room above is or is not heated. Once t_r is known, actual ceiling temperature t_h and actual surface temperature of the floor above t_b may be taken from table. Diagram in circle is used for illustrative problem in text. Large center diagram is used to find nominal tube size, center line distance of tubes, d, and water temperature. Small t_b diagram gives, for the stated coil design, the surface temperature of the floor above.

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Then we have the following constants for each panel

$$\theta_o\ (r, O) = \log_e \sin \frac{\pi r}{d} - \tfrac{1}{2} \log_e$$

$$\left[\sin^2 \frac{\pi r}{d} \cos h^2 \frac{2\pi A}{d} + \cos^2 \frac{\pi r}{d} \sin h^2 \frac{2\pi A}{d} \right]$$

$$\theta_o\ (O, -B) = \log_e \sin \frac{\pi B}{d} - \log_e \sin \frac{\pi}{d} (2A + B)$$

where $x = O$; $y = -B$

In these equations, the symbols t represent the various temperatures; r and d, the radius of the tube and the tube spacing; a and b, the thickness of the equivalent panel structure measured from the tube center in both directions to the actual surface, and A and B the thickness of the panel but including the boundary layers.

All variables discussed in previous installment are taken into consideration in these equations and errors resulting from a single assumption made when substituting the boundary condition are corrected by use of an empirical coefficient E which was found by comparing the computed results with those gained by tests on numerous panels of variable composition, location and structure.

Simplified Graphical Solution

A general graphical solution of these equations, including all kinds of panels, proved too cumbersome and, in order to simplify their use, several graphs were developed, each similar to Fig. 2, which give the necessary coil dimensions for a restricted number of ceiling or floor structures. Such graphs are available in the Chase Radiant Heating Manual. In a later edition of the manual, 15 to 20 graphs similar to that shown in Fig. 2 will give design dimensions for all conventional buildings and will cover over 200 different floor, wall, ceiling, and roof structures. A visual index will give the number of the design sheet to be used for each individual structure and from this sheet, the results may be read as shown in the following example.

Recapitulation of Heat Flow Theory

A short summary of the heat flow problem seems to be in order. Refer to Fig. 1, page 102, October, 1945 issue of HEATING AND VENTILATING. Heat is supplied to the system by means of hot water. Fluid enters the tubes with temperatures anywhere between 165F and 100F and by cooling down in the coils, releases parts of its heat content to the panel. The temperature drop

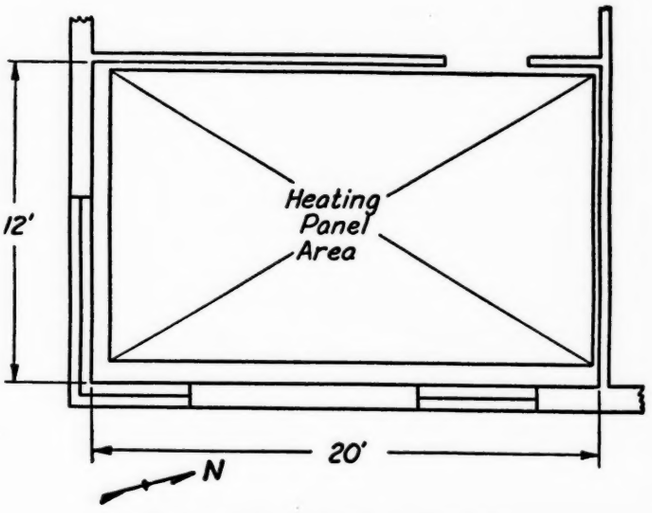

Fig. 3. Plan of room for example.

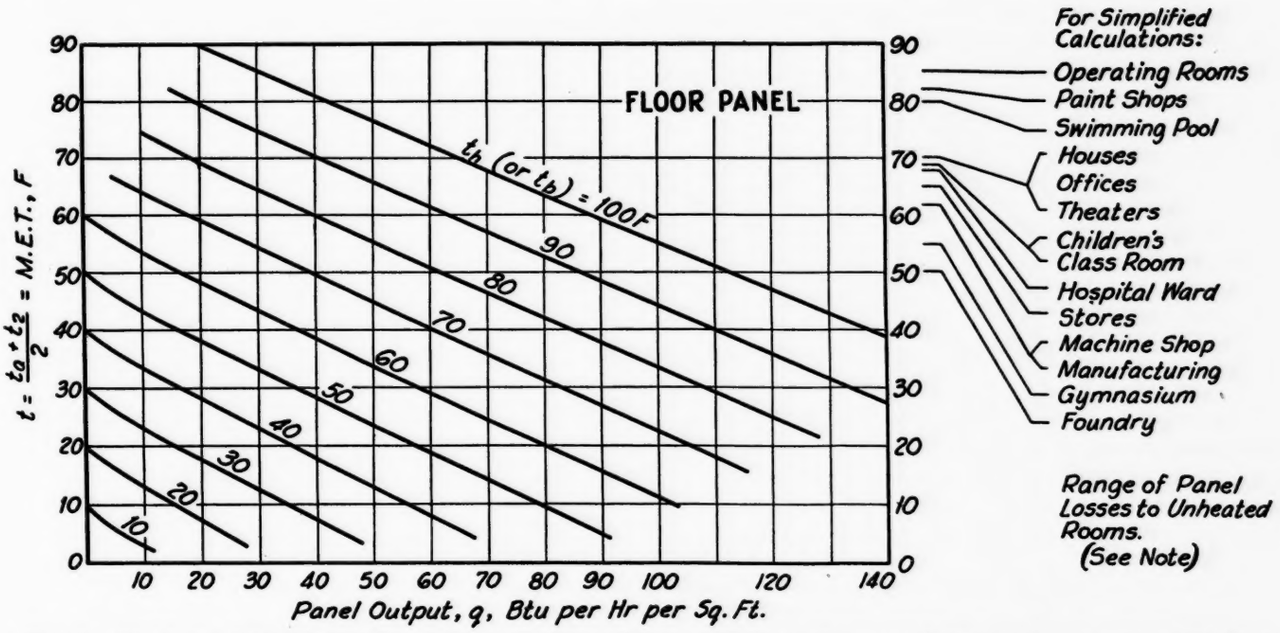

Fig. 4. Chart for determining the heat output for a floor panel for various panel temperatures, mean effective temperatures or comfort temperatures.

in the coils may be selected as 30F, 20F or less in special cases such as grid coils, etc.

From the tube circumference, the heat spreads radially and fairly evenly in all directions. However, the amount of heat carried upwards and downwards from the tube varies in accordance with the panel structure. Thus, in a ceiling panel of a frame structure, where the parts of the panel located above the tube have great heat flow resistance, the greater part of the heat is carried to the room below and possibly only 15% or less of the heat flowing through the tube circumference is directed up. In a ceiling panel, however, where the tubes are embedded near the lower surface of a concrete floor slab, over 50% of the total heat output of the tube may be diverted upwards to the floor above. This is because the overall flow resistance (which includes the air boundary at the floor) of the parts of the panel structure located above the tube is small.

By virtue of this heat flow from the tube, the lower and upper panel surfaces are heated to temperatures higher than that of the adjoining rooms. In order to maintain comfort, two principal considerations have to be kept in mind: (1) Restrict floor surface temperature to approximately 85F, ceiling temperatures from 100F with 7 ft ceiling height to 130F with 10 ft or more ceiling height. (2) Locate the coil in such a manner that the warmest parts of the panel are near the seriously exposed outside walls and glass.

From the warm panel surface, heat is lost by radiation and convection. The convection component is dissipated by the room's air, the radiation by the room's unheated enclosures, such as wall glass, etc. While great amounts of heat are transmitted directly to the glass and outside walls, some is radiated to inside walls and floors. No heat will be conducted through these areas to the neighboring heated rooms and for this reason these components of radiation are reflected. Practically, this means that a floor obtaining heat by radiation from the ceiling cannot absorb this heat but must re-emit it in the form of convection to the room air and in the form of radiation to the outside wall and windows. Here we see the reason why in a ceiling heated room the floor temperature is found to be greater than that of the room air, and why it is quite usual to measure a floor temperature from 2F to 5F in excess of that of the room air.

Most of the heat emitted by the panel is ultimately transported to the outside surfaces, wall and glass, where it is transmitted by conduction to the outside air. The balance of the panel output, by natural ventilation through cracks, etc., also is lost to the outside air.

All conditions described hold true only for the equilibrium state and cannot be applied to the heating-up period.

Simple Application of a Complicated Theory

Refer to the example started on page 110 of the October, 1945 issue. Note that the complete computation work required for one room is described by the last paragraph of that article plus the two following paragraphs herewith. Let us first review previous computations. The room to be heated is shown in Fig. 3; its floor and ceiling structure in Fig. 14, page 109, October, 1945 issue. It was decided to use a ceiling panel of 200 sq ft surface having a surface temperature, t_h = 109F. Although the MET in radiantly heated rooms is usually nearer 65F than 70F, we aimed at conservative results and it was decided to select a MET (t) of 70F. This will result in an overdimensioned panel, or a panel actually operating at lower surface temperature than that computed. Translated into physiological terms, the word "overdimensioned" is synonymous with greater comfort.

Sample Calculation, Coil Dimensions

The graph to be used for our specific ceiling structure is Fig. 2. Room temperature, MET = 70F;

temperature of attic above t_o = 20F; desired mean panel surface temperature, t_h = 109F. In the lower left corner we find a table coordinating the reference temperature t_r with the surface temperature t_h. It states that, if the attic above is of a temperature t_o = t — 50F = 20F, t_r may be found by: $t_r = t_h$ — 74F = 35F. Next we connect MET = 70F on the left hand scale with t_r = 35F on the right hand scale and find in the center diagram the following possible combinations, all of which result in the desired ceiling surface temperature.

- ⅜-in. tube on 4½-in. centers with 137F mean water temperature
- ¼-in. tube on 4½-in. centers with 142F mean water temperature
- ½-in. tube on 6-in. centers with 145F mean water temperature
- ⅜-in. tube on 6-in. centers with 150F mean water temperature

With a 30F temperature drop in each coil, we know from experience that ¼-in. tube may be used only in small coils. Since ½-in. tube is of too large an outside diameter to be buried in ¾-in. standard gypsum plaster, the ⅜-in. tube remains. To design economically, we select the highest water temperature, that is, ⅜-in. tube on 6-in. centers with 150F mean water temperature.

Calculation for Panel Heat Loss

A 200 sq ft coil using ⅜-in. tube on 6-in. centers was selected. The last step of our computation is concerned with the heat loss of this coil. If we had a heated room above our ceiling, the lost heat would be supplied to the room above, reducing its other heating requirements.

The temperature of the floor surface above our coil, t_b, is found by the use of the circled diagram in the center of Fig. 2. This circled diagram is a reproduction of the larger one and we note on it the point *A'* equivalent to point *A* on the larger graph. Connecting the temperature of our heated room, MET = 70F with *A'*, we find at the end of the dash line of Fig. 2, t_r = 28 +. Again, the table at the lower left of the figure coordinates t_r with t_b. For unheated attic above, $t_b = t_r$ — 2.5 = 25.5. That is, the temperature of the floor surface above is 25.5F and to find this floor's output to an attic of 20F, we consult Fig. 4. There we find for MET = 20F and t_h (or t_b) = 25.5F . . . q = 9 Btu per sq ft.

We find now the total heat requirement of our coil: Output, Q = 60 Btu per sq ft per hr; loss = 9 Btu per sq ft per hr; for a 200 sq ft panel, (60 + 9) 200 = 13,800 Btu per hr. Recapitulating our results, we have:

Panel area	200 sq ft
Output to heated room	60 Btu per sq ft per hr
Tube at	6 in. centers
Tube diameter	⅜ in. nominal
Mean water temperature	150F
Max. water temperature	165F
Min. water temperature	135F
Temperature drop in coil	30F
Total panel output	69 Btu per sq ft per hr

That is all the data required to design the coil.

Practical Considerations for Coil Layout

Wherever small water circulators of low pump head are used and ⅜ in. tube is embedded in a gypsum ceiling of a frame structure, the length per coil should not exceed 250 lineal feet. For this reason, the panel of our room, as indicated in Fig. 5, was made up of two individual coils.

The proper coil layout essentially influences the comfort in the room to be heated and for this reason Fig. 5 will be discussed in detail.

Selected as an example is the most critical condition, a corner room having high heat loss. In such rooms it will be necessary to coil the greater part of the ceiling

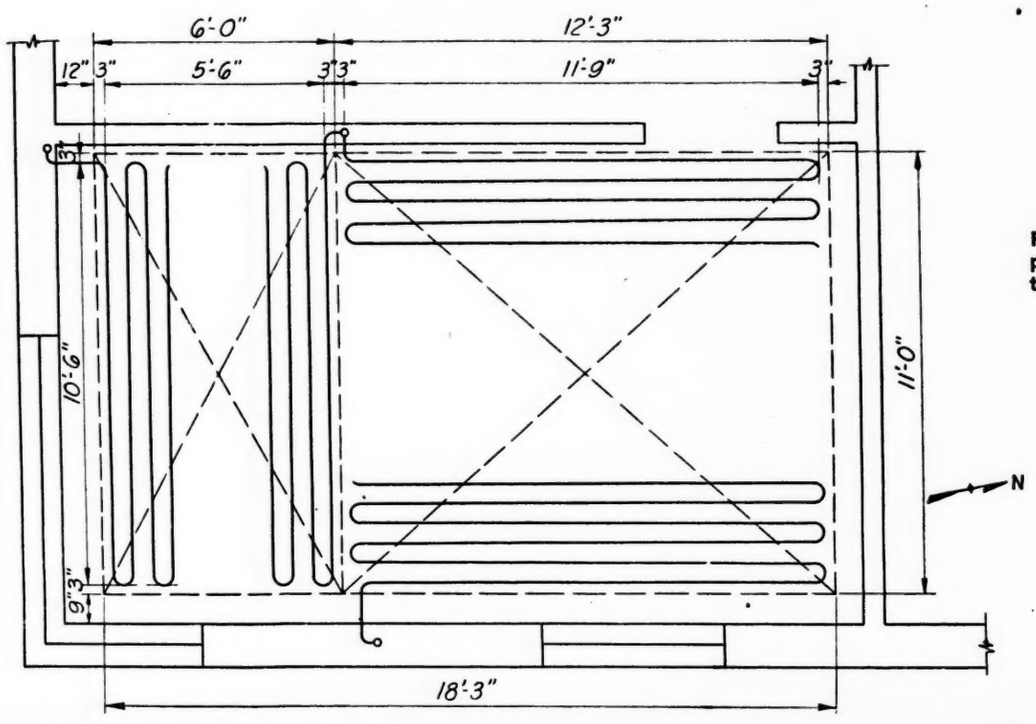

Fig. 5. Panel Layout for sample room. In order to restrict the pressure drop, panel was composed of two coils.

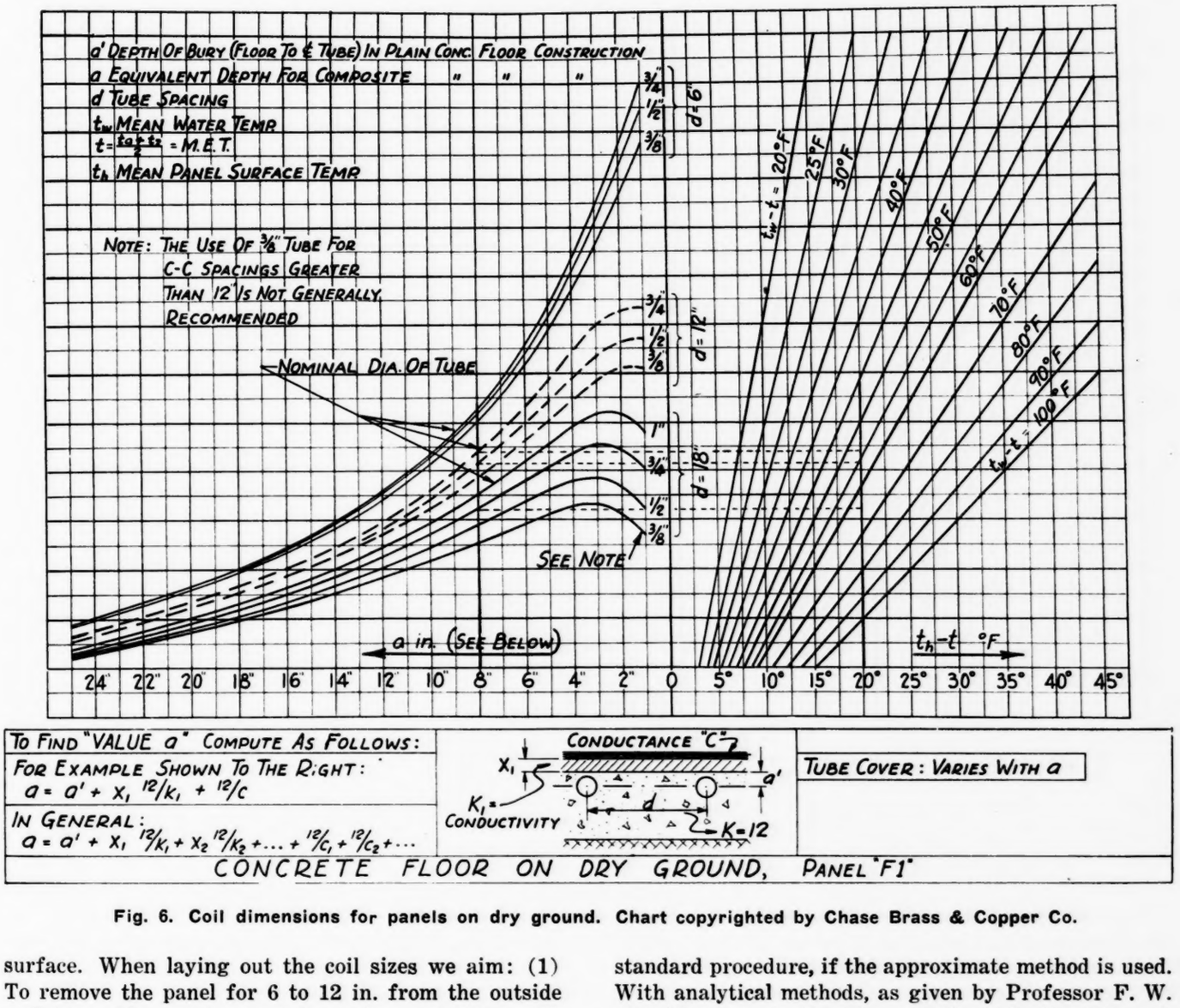

Fig. 6. Coil dimensions for panels on dry ground. Chart copyrighted by Chase Brass & Copper Co.

surface. When laying out the coil sizes we aim: (1) To remove the panel for 6 to 12 in. from the outside wall to avoid excessive heat losses by conduction; (2) To allow half of the tube center distance (3 in. in our case) from the panel outline to the centerline of the outermost tube in the coil; (3) To concentrate the warmer panel surface (near the coil inlet) at the outside walls and particularly at the more critical exposure. In this case it is the east wall. In radiant heating, as in all conventional systems, the heated surface should adjoin the walls having highest heat loss, for otherwise the inner section of the room will be overheated. Therefore, wherever possible, it is advisable not to panel from 20 to 40% of the section innermost from the ceiling or floor surfaces.

The panel surface temperature drops gradually from the water inlet at the outside wall towards the interior. To provide for a distinct temperature gradient of the panel surface, a 30F water temperature drop in such coils is desirable.

Computation of Heat Requirements

Although according to all authorities, the heat requirements of radiant heating systems are from 10—25% smaller than that of conventional systems, it is customary to compute the heat losses according to standard procedure, if the approximate method is used. With analytical methods, as given by Professor F. W. Hutchinson or in the Chase Radiant Heating Manual, the heat loss computations follow from the room heat balance and the conventional heat loss calculation cannot be used.

It is important to consider that in a room having, for example, 500 Btu per hr floor loss; 2000 Btu per hr ceiling loss; and 6000 Btu per hr for all other losses, the various coils should be designed to deliver the following amount of heat to the room:

A coil covering the entire ceiling,

$$500 + 6000 = 6500 \text{ Btu per hr.}$$

A coil covering the entire floor,

$$2000 + 6000 = 8000 \text{ Btu per hr.}$$

A radiator for same room,

$$500 + 2000 + 6000 = 8500 \text{ Btu per hr.}$$

Since the loss through the ceiling, for instance, flows directly upwards from the ceiling coil (refer to Calculations for Panel Heat Loss), this coil should not supply the computed 2000 Btu per hr to the room, in addition to the room's wall and floor losses.

Pressure Drop Calculations

The pressure drop is closely related to the diameter and length of coil used. Conventionally, 3/8-in. tube is used in ceiling plaster which is attached *underneath*

the metal lath. Let us inquire into the pressure drop of the larger coil of Fig. 5. The equivalent length of this coil is 275 ft, the panel area 135 sq ft and its output 135 × 69 = 9320 Btu per hour. With a 30F temperature drop, the water flow rate is 310 lb per hour. From flow tables for copper tube it is found that this flow results in a pressure drop of 0.25 in. per ft or 275 × 0.25/12 = 5.72 ft water head, which still can be covered by any small high duty circulator in addition to the head of the distributing piping. A coil pressure drop of from 6 to 7 ft head should not be exceeded. From this computation, it may be seen that a restriction of the length of tube per coil to 250 ft for such structures is safe.

In floor panels, where longer tube circuits and greater heat output per foot of tube are frequently met, it will be advisable to use ½-, ¾- or 1-in. tubing depending upon the length and output of the coil.

To save on computation work and also on the time required for balancing the systems, it is advisable, particularly in small buildings, to select a reverse return piping system. If, in connection with this system, a vent scheme is used where the water in the coil circulates in the direction toward the vent point (see HEATING AND VENTILATING, July, 1945, page 92, Fig. 4) a piping system will result with the main in the basement and an overhead return in the attic.

With direct return, it will be advisable to compute carefully and size all circuits, and to place the boiler as near the longest heating coil as possible. For venting, draining and installing radiant heating coils, see previous articles in this series.

Panels Laid on Dry Ground

All computations are simplified if the panel has only one surface and the structure is laid on the ground. Fig. 6 shows the graphical solution for such a panel. The table at the lower left corner of this figure shows how the equivalent depth of bury a is computed. Knowing this depth as well as the required panel surface temperature, t_h, and the room temperature, t, or MET, the possible combinations of tube diameter, distance and water temperature may be read off the table. For instance, given:

$$a = 8,\ t_h = 85F,\ t = 65F,\ t_h - t = 20F$$

We then find the following combinations:

Tube nom. dia. 2r (in.)	Tube distance d (in.)	$t_w - t$ (°F)	Mean water temperature t_w (°F)
¾	18	64	129
1	18	61	126
½	12	55	120
¾	12	54	119

Any one of the combinations found will satisfy the heat requirements of the room.

Concluding Notes

Radiant heat is not only the most modern method in the field of heating, but also ranks at the top with respect to living comfort. This quality results from the following properties of radiant heat:

a. Low temperature of the heating surface
b. Relatively low air temperature and high humidity
c. No drafts
d. No dust collection
e. Evenness of temperature throughout the room as sensed by the human body
f. Large fuel savings.

However, and this should be noted by all designers, radiant heat may be deficient in one or all of these points unless the system is properly designed. For instance, when computing floors for 110F or ceilings 7 ft high for 120F surface temperature, line (a) will not hold true. When locating the warm parts of the panel near the inside walls rather than near the outside walls, properties (c) and (e) cannot be obtained. By using small wall panels of high surface temperature, dust may be deposited—see point (d). By locating the heating panels too near the outside wall, great heat losses (point f) may occur.

Hence, we can state that the radiant heating system is as good as its designer. This statement must hold true at least as long as the principles of designing such systems are not generally known. As more and more systems are installed and experience gained in their performance, the proper design principles will become common knowledge. The design of such systems will then be reduced to mere routine.

At the present time, however, it is good to keep in mind the following points:

Design for lowest possible temperature of heated surface.

Space tubes not too far apart in order to obtain even surface temperature.

Concentrate the panels or the warmer parts of the panels near the outside walls.

Cover at least 40% or 50% of the entire floor or ceiling by panel.

Do not place heating tubes too near the outside wall.

Properly compute the heat loss of the building and the pressure drop in the piping system.

Carfully consider venting and draining properties of piping.

ANY QUESTIONS?

This is the concluding article of Mr. Vanderweil's series. The author has consented to attempt to answer questions on radiant heating; these answers will appear in subsequent issues. In the meantime readers are invited to submit their questions to the Editor, HEATING AND VENTILATING, 148 Lafayette Street, New York 13, N. Y.

Locating Unit Heater Thermostats

T. W. REYNOLDS

This is the third consecutive article on the general theme of unit heaters. The April issue contains a reference section on the various steam and hot water types of unit heaters; the reference section for May is on hook-ups for unit heaters and steam main drips.

WHAT would an industrial plant be like without unit heaters? What fun we have in spotting these units around the areas! How carefully we place nice-looking rectangles, representing the heaters, with accompanying arrows showing air discharge at strategic points on the plans, all tied together so neatly with strings of pipe. But wait! Where are the controlling thermostats? Well, they are there, not readily apparent at first glance, each denoted by the letter T inscribed in a circle, and located, as a rule, with utter abandon.

The writer has never been too confident in locating a unit heater in one place where it will distribute the heated air most advantageously and then locating the thermostat on the nearest building columns for control of heat in a different environment. In most of the the literature, too much importance seems to be placed on the correct heater location, too little on the most suitable place for the thermostat. Of course, thermostats cannot be located ideally because of physical limitations and, therefore, the spotting of these controls is just a sort of nuisance. Who would put a thermostat in Brooklyn to control a unit heater in New York? No one, and, yet, relatively, that is just what is done in many an installation.

Fortunately, in many cases these remote controls function fairly satisfactorily because the space in which the heater is located often has substantially the same heat loss as the space in which the thermostat is located. This is typified by *2* and *3* in Fig. 1. Here the two thermostats are conveniently placed together for wiring by the electrical contractor to control unit heaters installed by the heating contractor—two contractors with divergent interests. Curious indeed is this division of responsibilty.

It must be admitted that the thermostats for *2* and *3* are not theoretically located correctly. Theirs is a sheltered environment as compared to the exposed space to be heated. Such location, however, is usually not so adverse but that it can be compensated for by setting the thermostats for higher temperatures. While the two environments (near outer walls and at columns) will at times vary in their rate of heat loss, yet at most times the variation will be negligible.

In the case of the corner space *1* the control of temperature is more difficult. The thermostat setting at a point which will maintain 70F in the corner with the sun shining on the large glass and wall area of the two exposures, and with the wind just a zephyr, won't be high enough when the sun begins to set and the wind blows strong. Neither sun nor wind will effect corresponding changes at the thermostat location. If the thermostat is set higher, then the wind may shift making the exposed area the leeward rather than the

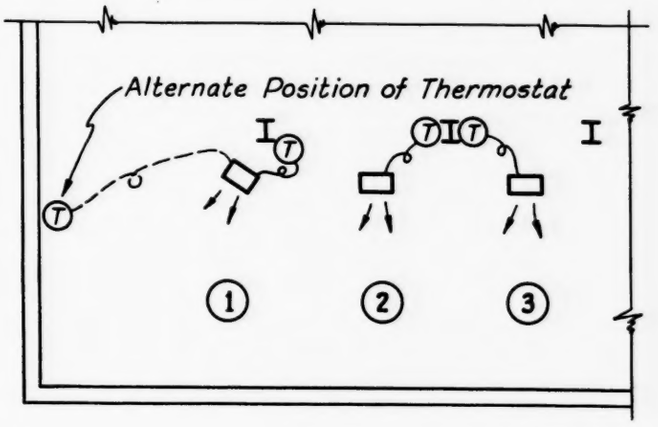

Fig. 1. Locating thermostats for corner areas.

windward side. As a result exfiltration of air takes place instead of infiltration, and the space gets too much heat.

Apparently the only remedy left for such corner spaces, especially where bays are so wide and so deep that the nearest column is far rather than near, is to install the governing thermostat on the cold outside wall. To do so is a form of heresy, but with a proper insulating base back of the instrument, all should be well.

There is one type of building where the proper location of the thermostat is a fairly simple matter; warehouses, where heat is required solely for keeping the sprinklers from freezing. In other type of installations the thermostat cannot be located at the return of the unit heater because the heated air accumulated at the roof (either from convection or sun effect) would delay the heater starting. Such a condition, however, is ideal in the case of sprinklers, and can be made even more so if the unit heaters are of the low velocity type without deflectors, so that the maximum amount of heat will be stored at the ceiling where it is required.

Incidentally, the greater the number of unit heaters the better the temperature regulation with unit heaters, due to the greater number of thermostats used.

How to Test the Performance of an Exhaust Ventilating System

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THE purpose of an exhaust system is to bring dusts, vapors, gases, fumes and nuisance materials into a hood and to convey them to a suitable place of disposal. This is accomplished by creating an air movement in the vicinity of the source where these substances are generated. The air movement must be great enough to keep the substances from dispersing into the air. Hence, the effectivenss of an exhaust system depends upon the provision of an *adequate* air movement at the source.

What is the magnitude of air movement required? This will depend upon the kind of material to be controlled and the way it is generated. For example, dust from a grinding wheel not only has directional energy to be overcome, but also the "fan-action" of the wheel which tends to disperse the dust outward from the hood. On the other hand, vapors from a tank require control over a relatively large surface.

A great deal of experience is available regarding the velocities necessary to control different substances. However, before we list their values, it is well to point out that hood design has much to do with the effectiveness of these velocities. Below are items to be considered in designing a hood before any estimate of air velocities or air volumes is made:

1. Get the hood as close to the source of trouble as possible.
2. Arrange the hood so that it does not interfere with the worker.
3. Enclose the source, if possible, but always leave enough opening area for air to enter; otherwise the material will not be carried away.
4. Take every advantage of the direction in which the material is dispersed.

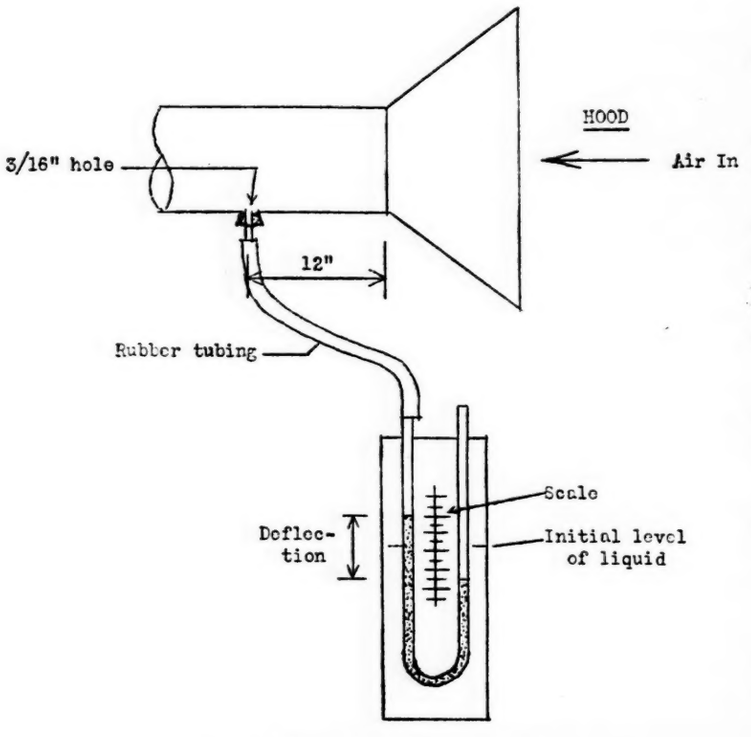


Fig. 1. Measuring static pressure.

These are the chief elements entering into the physical design of a hood. If followed it will be found that they will help greatly in eliminating the substance to be controlled and at the same time require the minimum amount of air necessary, all things considered. In the final analysis, an appreciation of the precautions listed will tend to reduce the cost and maintenance of the system.

In the following table are given the air velocities or air volumes necessary to control various substances.

Table 1—Air Velocities or Volumes Necessary to Control Various Materials

Operation	Air Velocity or Air Volume	Remarks
Bagging powdered material	200-400 fpm	Velocity over opening in which bag is set.
Metal spraying	500 fpm	Velocity over opening. Work located under hood. Spraying done from outside.
Belt conveyors. Fine materials (transfer points)	250 fpm	At transfer points.
Welding	150-200 fpm	At work area.
Paint spraying	100-150 fpm	Across opening of hood or booth.
Offset spraying	300 fpm	At hood opening.
Electroplating	100 cfm per sq ft tank surface	Exhaust at edge of tank by slots 1 to 2 inches wide.
Swing grinding	200 fpm	Work inside of booth. Operator inside. Velocity across opening.
Soldering	150 fpm	Near work.
Burring	200 fpm	Worker inside booth. Velocity across booth opening.
Screening	75 cfm per sq ft	Complete enclosure. Flat deck screens.

Requirements for grinding wheel hoods are not listed since these are generally set by state codes. Later the significance of these requirements will be discussed, especially the significance of static suction, in which terms the requirements are stated. It is clear from

Fig. 2. Chart for converting static pressure reading at hood to duct velocity at point of measurement. This scale simplifies computations by giving air velocities direct from U-tube readings.

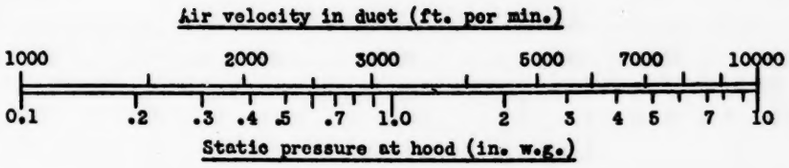


Table 1 that, in general, most substances are controlled when the air velocities at the source are roughly about 200 fpm.

Testing

There are two ways of testing the effectiveness of an exhaust system: (1) by determining the amount of a substance which actually gets into the air, or (2) by testing the performance of the system in terms of the amount of air it is handling. Usually, the first method is beyond the means of most engineers and is rather intricate. It involves taking air samples, and though this is often quite necessary where the substances escaping from the system are injurious to health, it is still preferable as a first step to determine what the system is doing. We are concerned with the second step because the effectiveness of a system is more often than not a matter of using the proper hood and handling the right amount of air. Moreover, the methods of testing a system are within the abilities of most engineers or maintenance men. We intend to show the procedures to be used by means of a series of steps. We shall assume that the person testing the system was not originally engaged in its design, so that nothing will be taken for granted. However, the procedure has universal application regardless of what is assumed.

Step 1—Lay out the system on paper, not necessarily to scale, and indicate the size of duct work, in sub-branches, branches and mains.

This should be done because often a system has added to it one or more branches to take care of extra machinery; or else branches may be moved. A well-designed system is one where the main duct at any point has an area equal to the area of all the branches together from the farthest end to the point in question. Take for example the layout shown in Fig. A. What should the area of the main at A_3 be?

Beginning with the most remote end, we have a diameter of 7 in. This corresponds to an area of 38.5 sq in. It is joined just before the point A_1 by a 5 in. duct having an area of 19.6 sq in. The area at A_1 is therefore $38.5 + 19.6 = 58.1$ sq in. The diameter at A_1 will be, therefore, that which will give an area of 58.1 sq in. This we may estimate from Table 2.

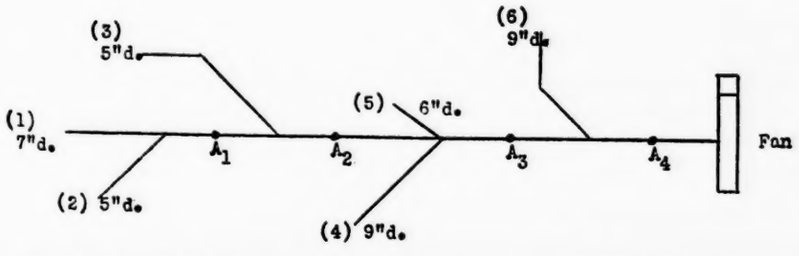


Fig. A. Layout of simple system for purpose of illustrating problem.

Table 2—Table of Areas

Duct Diameter, Inches	Area, Sq Ft	Duct, Diameter Inches	Area, Sq Ft
2	0.022	16	1.40
3	.049	17	1.58
4	.087	18	1.77
5	.136	19	1.97
6	.196	20	2.18
7	.267	21	2.40
8	.349	22	2.64
9	.442	23	2.89
10	.545	24	3.14
11	.660	25	3.41
12	.785	26	3.69
13	.922	27	3.98
14	1.07	28	4.28
15	1.28	30	4.91

Solving for the diameter to the nearest half-inch we see that the diameter at A_1 is 8½ in. Next we have a branch of 5 in., and adding this area to the area at A_1, we get the area at $A_2 = 58.1 + 19.6 = 77.7$ sq in. Adding to this the areas of the 6 in. branch (28.3 sq in.) and the 9 in. branch (63.6 sq in.) we get:

Area $A_3 = 77.7 + 28.3 + 63.6 = 169.6$ sq in.

and we see from our table of areas that the diameter equivalent to this area, to the nearest half inch, is 14½ in.

Continuing, to the last branch, 9 in. (63.6 sq in.) we get the area at A_4.

Area $A_4 = 169.6 + 63.6 = 233.2$ sq in.

The diameter equivalent to this area, which is also the area of the fan inlet, is slightly more than 17 in.

The value of the above rule of areas lies in the fact that it assures a uniform air velocity through the system. If the rule is not followed we are enabled to discover whether the system is overloaded.

The rule of areas often reveals what is fundamentally wrong with a system.

A more rapid method of checking areas is possible by observing that the areas are as the squares of the diameters. The branches (1) to (6) may be listed as in Table 3.

Taking the square roots of the numbers corresponding to A_1, A_2, A_3, A_4, we get 8½ in., 10 in., 14½ in., 17 in. which are exactly the same as before.

Often State codes require that we add 20% to the area of the main at every point where a branch enters. Where this is required, we get the diameter of the main corresponding to an area 1.2 greater than those calculated as we have done above.

Step 2—Check the air flow.

Checking the air flow is more easily done than most engineers realize. There is really

Table 3 — Data for Layout in Fig. 1.

Branch	Diameter, In.	Diameter²	Cumulative Sum
(1)	7	49	49
(2)	5	25	74 (A_1)
(3)	5	25	99 (A_2)
(4)	9	81	180
(5)	6	36	216 (A_3)
(6)	9	81	297 (A_4)

nothing mysterious about moving air in spite of the prevailing opinion that "it's hard to do anything with air". There are many special devices available on the market, some of them direct reading; but by far the simplest method, well within the reach of anyone, is described here. This method consists of a glass U-tube with water in the arms to the half-way mark. The U-tube should have an internal bore of about 3/16 in. although it may be larger. An overall length from the bottom of the U to the tip of 10 in. is enough. A distance of 1 in. to 1½ in. between the arms is enough. The tube may be mounted on stiff cardboard, plywood or metal. For convenience, a scale marked in inches may be placed between the two columns, with the zero of the scale even with the level of water in the column. To obtain adjustment either the scale or the U-tube may be moved up or down, or if this is not possible, the deflection of the columns (to be explained) can be obtained by difference (Fig. 1).

If one arm of the tube just described is tapped to an exhaust system at any point up to the intake of the fan, the suction will raise the water level on the arm connecting the system, and lower it on the other. The total deflection, that is the distance in inches between the water level in the columns, gives the suction. The amount of deflection in inches is called the static suction at the point of measurement expressed in inches of water gage (wg). If the tube is tapped to the system on the pressure side of the fan, the connecting column is lowered and the other raised. The deflection measures the static pressure. Usually the term static pressure applies whether the pressure is positive or negative (suction).

It is possible by measuring the static pressure at certain points in a system to determine air velocity and performance. One of these points is just behind the hood, at a distance of 12 in. to 15 in. from the point at which the hood joins the duct. If in Fig. 1, the U-tube is connected in the manner shown, the velocity of the air at the connecting point is equal to:

Velocity (ft per min) = 3200 × square root of deflection (inches).

The duct may be drilled and a short nipple of copper or brass 3/16 in. diameter may be placed snug against the opening. The nipple is connected by means of a rubber tubing to the U-tube. In order to simplify computations a conversion scale is shown in Fig. 2, so that if the deflection is known the air velocity in the duct is obtained in a glance. Suppose, for example, the

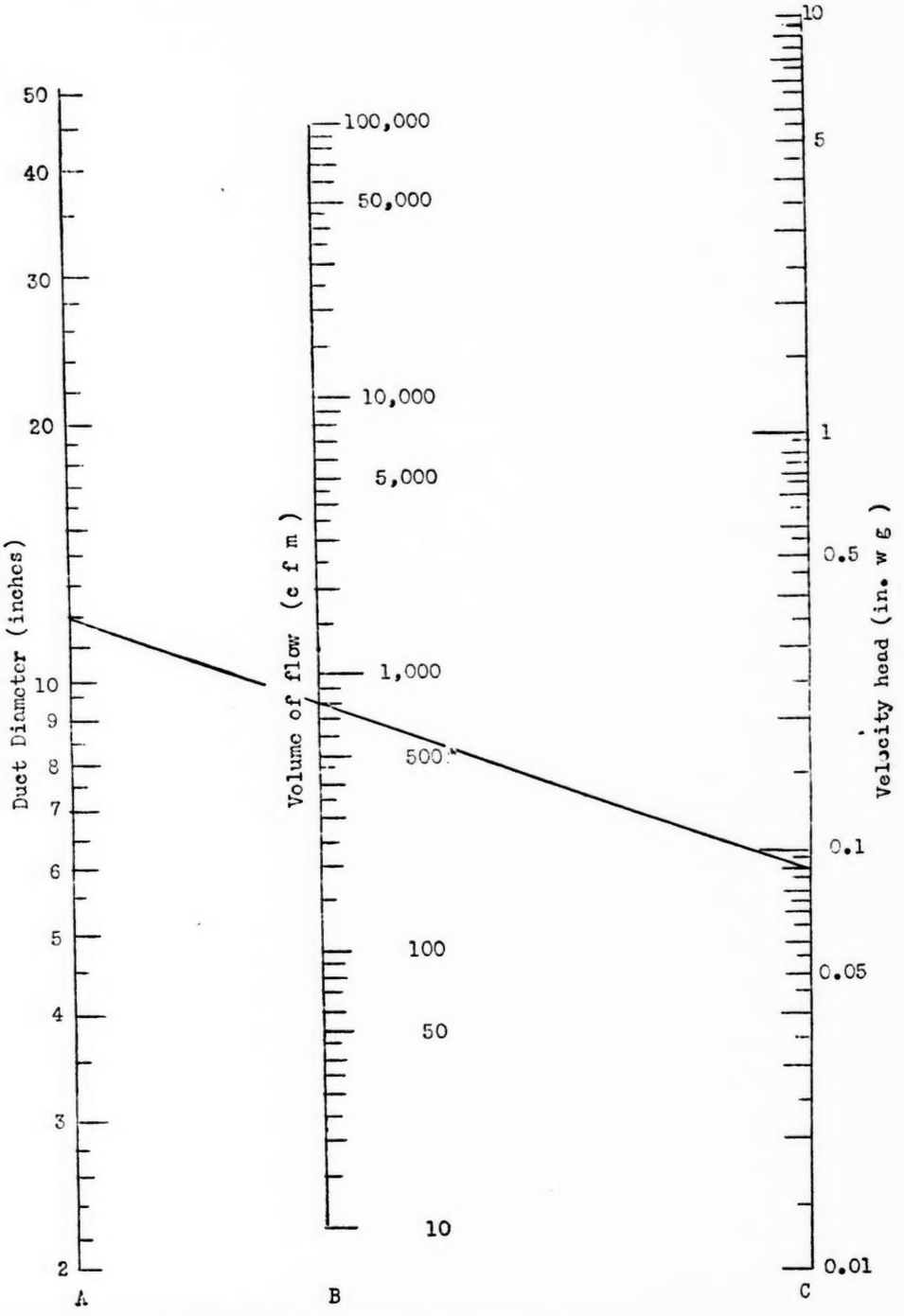


Fig. 3. Chart for determining air volume from pitot tube readings.

deflection observed is 2½ in. wg. Referring to the chart we see that the air velocity is slightly less than 5000 fpm.

In use the U-tube is held vertically. If the tube is clean, readings as low as 0.1 in. are readily obtained.

The use of the term "static suction" or "static pressure" in state codes refers to the deflection measured as we have described above. It is a convenient procedure, and gives pertinent information. However, static suction does not give any other measure except velocity when used as we have above. More often than not, air volume is important, and for this reason, State codes also stipulate duct diameter whenever the term static motion is used.

Step 3—Air volume.

When the duct diameter at the joint at which we measure the static suction of a hood is also known the volume of air flowing is obtained by multiplying the air velocity in feet per minute by the area of the duct in *square feet.* This gives the volume of air in cubic feet per minute, that is:

Volume of air (cfm) = 3200 × area of duct (sq ft) × square root of U-tube deflection.

Again for convenience, we have set up a nomogram chart for simplifying the computations (Fig. 3). This chart is slightly more complicated than the one given in Fig. 2. It consists of three scales; the pipe diameter in inches, the volume of air flowing in cfm and the deflection of the gage in inches. This chart permits the calculation of any of these items when the other two are known. For example, suppose we observe the U-gage deflection at the throat of the hood to be 3 in. and the diameter of the duct is 12 in., what is the volume of air flowing? To use the chart, simply connect by means of a ruler or straight edge the point 0.09 on the deflection scale and the point 12 on the duct diameter scale. The intersection of the rule edge with the remaining scale gives the volume of air flowing, in this case about 800 cfm.

The procedures just outlined may be repeated for every opening and thus the amount of air handled by a fan may be estimated. The accuracy of the procedure outlined is about plus or minus 10% for most industrial exhaust systems.

Often it will be found that dust settles in a duct system. This is usually due to insufficient velocity. Most dusts are conveyed at velocities exceeding 3000 fpm. At lower velocities dusts begin to settle. Hence in such instances from the air volumes and pipe diameters we are enabled to calculate velocities in any part of the exhaust systems and check them against the usual requirements.

If Q is the air volume in cfm, V the velocity in fpm, D the duct diameter in inches, h the deflection of the U-tube in inches, and A the area of the duct in square feet, we have the following formulas:

$$(1)\quad Q = AV = \frac{\pi D^2}{4 \times 144} \times V = 0.0055D^2V$$

$$(2)\quad V = 3200\sqrt{h}$$

$$(3)\quad Q = 3200 \times A\sqrt{h} = 17.6D^2\sqrt{h}$$

For measurements made at hoods.

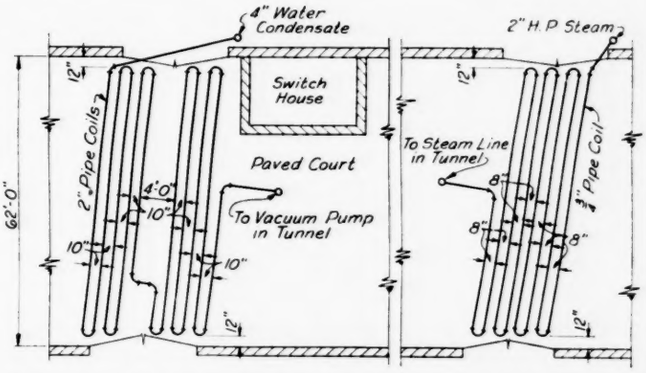
Snow Melting Systems for Driveways

Two radiant heating systems for snow melting have been installed in driveways at the Chevrolet-Gear and Axle plant, Detroit. One has been in service during a mild Detroit winter and the other has not had an opportunity to be placed in service. Some features of the system are described.

The unit which is connected to the condensate return line of the plant heating system was in service all last winter and was highly satisfactory. As the last winter was an open one, the test was not truly representative. However, at no time was there any snow accumulated on the heated sections of pavement. Shortly after snow or rain stopped falling, this pavement was dry and made a convenient and safe passage between the two buildings.

The system connected to the steam line was not turned on last year because of the UAW strike. Although I do not know if any operating difficulties will be experienced, I see no reason why it should not operate as satisfactorily as the condensate setup.

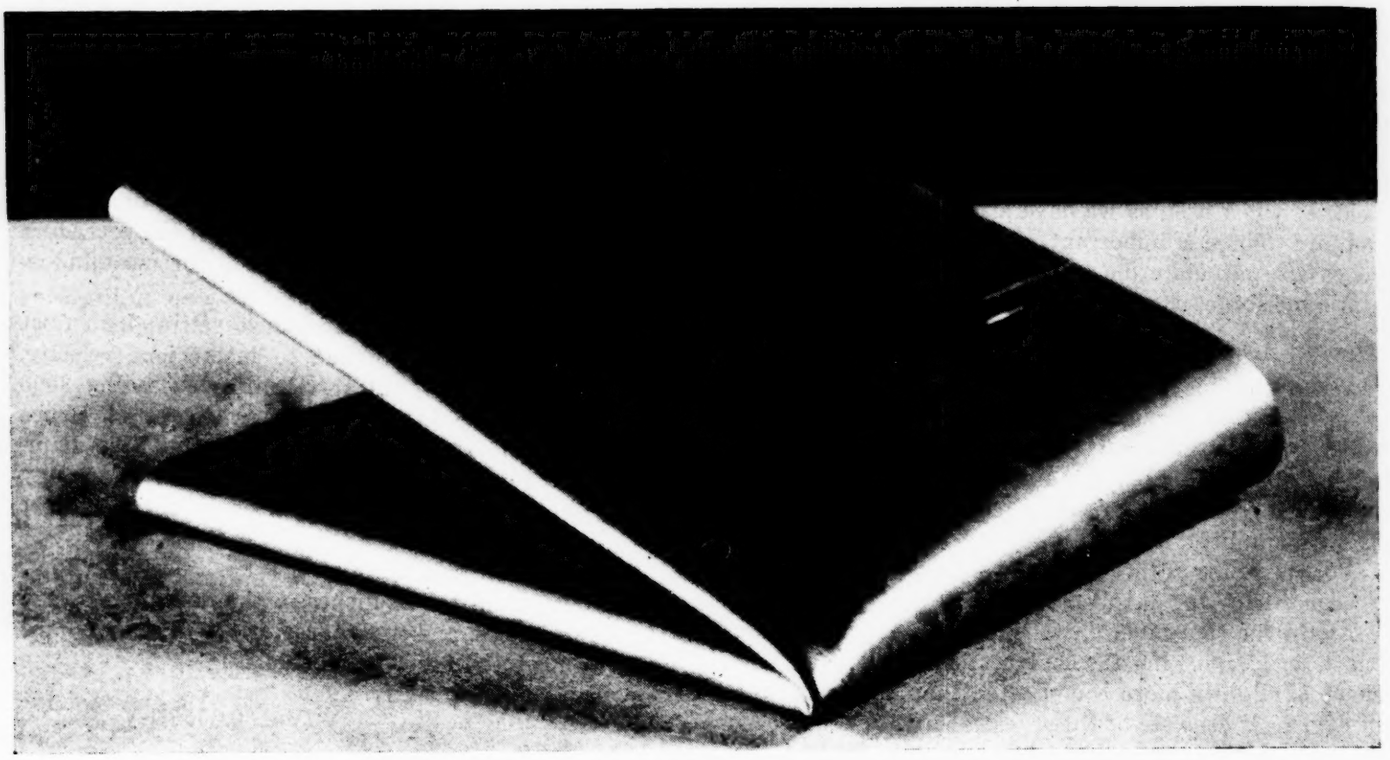
The dimensions were not held precisely to those shown in the illustration. It was simply a case of installing approximately that many lengths of pipe in the concrete base of the driveway while it was in the process of being replaced. Therefore, the cost of the installation consisted only of the labor necessary



Two pipe coils in driveway for snow melting. Coil at left uses condensate return for heat. Coil at right uses steam.

to lay the pipe, and the cost of the pipe. The pipe center was placed 4 in. below the paving brick; the concrete base of the roadway is 8 in. thick.

Since the one installation that has seen service has been satisfactory, I believe that we will install more such units in other locations about our plants. It seems to me that the ideal place to connect them is in the condensate return provided of course the flow is sufficiently constant and in large enough volume to prevent any possibility of freezing.—D. D. Douglass, Plant Engineer, Chevrolet-Gear and Axle Division of General Motors Corp., Detroit, Mich.



Bend test to show how coating will withstand bending over a diameter equal to twice its own thickness.

Aluminum Coated Sheet Steel

BY means of a patented process, molten aluminum is applied to both sides of sheet steel to form aluminized steel. The product has the surface characteristics of aluminum and the physical properties of steel. The standard coating of 0.5 oz per sq ft results in an aluminum thickness of about .001 in. per side, which is used for all gages and grades of aluminized steel. The sheet may be obtained in either dull or extra smooth finish.

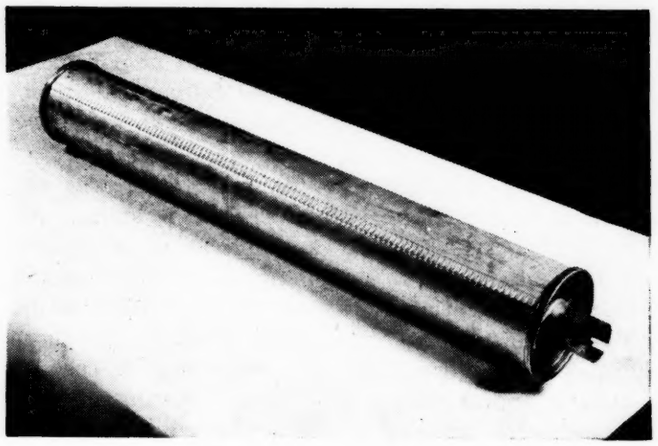
Aside from its ability to resist corrosion, aluminized steel withstands temperatures up to about 900F without discoloration and up to approximately 1600F without destructive scaling. Above 900F a metallurgical change starts to take place in the coating. It begins to alloy with the steel base to form a light gray surface layer of iron and aluminum. This alloy continues to protect the steel base at temperatures to about 1600F, but at 2000F this alloy turns to a whitish oxidized scale and then fails. Once the protective alloy has formed, cooling will not bring back the coating to its original state.

Aluminized sheet steel has high heat-reflecting properties. Photographs made with infra-red film show that the aluminized sheets turned back a large part of the infra-red rays emitted from a heat source, rays of which were directed to the photographic plate. These were the materials tested in the order of their heat reflectivity:

1. Stainless steel No. 7 finish.
2. Aluminized steel buffed finish.
3. Regular galvanized newly produced.
4. Stainless steel No. 4 finish.
5. Aluminized steel dull finish.
6. Stainless steel No. 2 finish.
7. White porcelain enamel.
8. Porcelain enamel blue ground coat.
9. Black iron.

Aluminized steel can be bent 180 degrees cold over a diameter equal to twice its own thickness without peeling or flaking of the coating. Also the steel base will not fracture when bent on itself.

This sheet can be welded by any of the common



Muffler outer shell of aluminized steel has long life under heavy exposure to heat and corrosion.

processes—oxy-acetylene, electric arc welding, spot welding or seam welding. It is difficult to solder and braze.

When oxy-acetylene welding, a paste flux must be applied to the seam to carry off the aluminum oxide. A shielded arc electrode is considered best for electric arc welding.

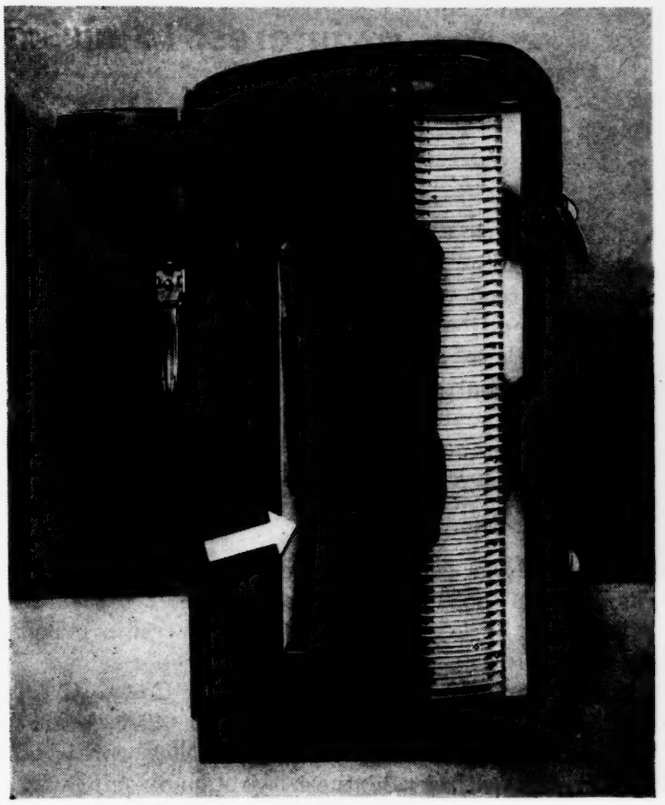
Before the sheet is spot welded it should be cleaned to insure uniformly sound and strong welds. For cleaning, a standard degreasing compound can be used, following which the work should be rinsed in hot water. In order, the other steps are a dip in cold 3% hydrofluoric acid, a rinse in running water to scrub off the sludge, and then air-drying before welding. A hot soap solution can be used instead of the degreaser compound. Instead of the chemical method of cleaning, a light pass with a power-driven wire brush is also effective.

Since the aluminum coating increases electrical conductivity, spot-welding aluminized steel requires more electrical energy than plain uncoated sheets. For coated sheets .018 in. and lighter, amperage requirements will be up to 50% greater than for plain steel sheets. However, this difference is reduced as the thickness of the sheet increases. Amperage required by aluminized steel .08 in. thick is only 20% greater than for the plain steel.

When seam welding, it is necessary to keep streams of water on both upper and lower rolls to secure maximum cooling effects and to reduce the amount of aluminum that adheres to the rollers.

For brazing, a high-strength aluminum alloy brazing rod and a suitable flux should be used. Copper zinc-alloy rods and silver solder are not practical for production use. Since the brazing alloy will not bond with the steel, the strength of this joint is only as great as the union between the aluminum coating and the steel, and strength of joint must be obtained from lock seams or rivets.

Because of the insoluble aluminum oxide film, special procedures are required for soldering. One method is to first electroplate with copper or nickel and then to apply the solder to this new surface.



In this coal burning heater the combustion chamber, shown with arrow, is made of aluminized steel.

Where it is necessary to apply an aluminum coating to a weld, the best method is metal spraying. However, it is first necessary to mask or protect the area around the weld and sand blast the weld to remove slag and oxides.

While the aluminum surface has better paint-holding qualities than galvanized steel, it is not recommended for direct paint applications.

Information and illustrations provided through the courtesy of The American Rolling Mill Co., Middletown, Ohio.

Reflective Insulation Under Wooden Floors

Tests were made by the National Bureau of Standards to determine whether condensation would form in air spaces where reflective insulation was installed below a wood floor that was laid over a crawl space.

The insulation consisted of asphalt paper faced both sides with a layer of aluminum foil, and each layer of insulation had one ⅛ in. hole for each square foot in order to permit condensation drainage, if any.

Several interesting conclusions could be summarized as the result of this investigation.

1. Condensation will not occur in wooden floors over crawl spaces, where reflective insulation is installed in a normal fashion with some percentage of openings which permit air to pass through.

2. The temperatures of such insulation surfaces should remain above the dew point of the air in contact. Relative humidities of the air in the spaces within the floor structure are unaffected by opening or closing the crawl space.

3. A perfect vapor seal by means of the reflective insulation, or other material, is neither necessary nor desirable and would probably permit condensation to occur in some cases. Perforations, of the order used, assure air flow upward through the floor structures, and provide drainage for water which might leak through the floor from above.

4. Reflective insulation provides a marked rise in the temperatures of the floor surface.

Recent Court Decisions

of interest to air conditioning engineers

LEO T. PARKER

NOT often have the higher courts given as many outstanding decisions involving air conditioning as has occurred recently. Obviously, it is important that air conditioning engineers know the cause and outcome of these new law suits so that they may avoid similar legal controversies.

For those who desire all details regarding these new decisions, references are given to specific citations.

Liable As Partner

Modern higher courts consistently hold that a person who acts in such a manner as to induce others to believe that he is a member of a partnership makes himself liable as a partner.

For example, in American Furnace Co. *v.* Great Southern Air Conditioning Co., 16 So. (2d) 140, it was shown that a person named Neelley furnished capital for the Great Southern Air Conditioning Co., and prepared and signed the partnership's financial statement, on faith of which a seller extended credit to the partnership.

In subsequent litigation the higher court held Neelley fully liable to the seller although the testimony showed that actually Neelley was not a partner in the air conditioning company. This court said:

"This financial statement was unquestionably made up and signed as a means of procuring credit. It effectuated that purpose."

Contractor Solely Responsible

According to a late higher court decision a contractor, and not the manufacturer of air conditioning equipment, is obligated to ascertain unusual local conditions which may result in the unit failing to operate satisfactorily.

For illustration, in Fairbanks, Morse & Co. *v.* A B C Oil Burner & Heating Co., 24 So. (2d) 393, reported March, 1946, the testimony showed:

The A B C Oil Burner & Heating Co., Inc., was domiciled in New Orleans where it was engaged in the business of supplying, installing and servicing oil burners and heaters for buildings. Later it expanded its operations to include the sale and installation of air conditioning units. Its venture into the air conditioning contracting business was suggested by Fairbanks, Morse & Co., engaged in the manufacture of different types of air conditioning systems and units. The A B C Company acted as one of the New Orleans dealers of Fairbanks, Morse & Co.

The A B C Co. contracted with a Mr. Palmer to install air conditioning in his office. The A B C Co. had representatives of Fairbanks, Morse & Co. visit the suite which Mr. Palmer occupied and make certain drawings setting forth the proposed air conditioning system and the type of unit which would be necessary to accomplish the desired result. Upon recommendation of representatives of Fairbanks, Morse & Co., the A B C Co. placed an order with the former for the purchase of one SCH-60W self-contained air conditioning unit and equipment.

Upon completion of the job, Mr. Palmer refused to accept the work. He claimed that the air conditioning unit did not produce the results guaranteed by the A B C Co. because it failed to cool the air conditioned spaces to an average temperature of 80F when the outside dry bulb temperature was 95F. Upon Mr. Palmer's refusal to pay the contract price the A B C and Fairbanks-Morse companies undertook to make certain changes in the unit in an endeavor to have it comply with the guarantee contained in A B C's contract with Mr. Palmer.

Upon the completion of these changes, Fairbanks Morse taking the position that the air conditioning unit was operating properly and that it fully complied with all warranties concerning performance which it had made to A B C at the time of the sale, demanded that A B C pay the purchase price of the unit. This demand was refused and Fairbanks Morse filed suit against the A B C Co.

Inadequate Water Supply

In the meantime it was definitely established that the unit operated perfectly and that it was sufficient in size to cool Mr. Palmer's office to the extent specified in the contract and that the reason why the unit did not do so was due to an inadequate water supply during the summer months when the city water temperature was very high. It is interesting to observe that the higher court held the A B C Co. solely liable for full payment to Fairbanks Morse although Palmer was not required to pay the A B C Co. This court said:

"We are obliged to conclude that the only cause of the failure of the unit to cool Mr. Palmer's offices to the extent represented by A B C Co. in its contract is due to the inadequacy of water supply. In these circumstances, the question arises as to whether it was the duty of Fairbanks, Morse & Co. or A B C Co. to have ascertained, prior to the installation of the unit in Mr. Palmer's office, that the water to be supplied to the unit would be sufficient to make it function in conformity with the guarantee of A B C Co."

The court held that it was the duty of the A B C Co. to ascertain whether the temperature of the city

water was too high to permit the unit to operate satisfactorily.

Another important point of law decided by this court involves guarantees given by manufacturers to contractors. The guarantee given to the A B C Co. by Fairbanks Morse, stated:

"It is expressly understood that there are no verbal understandings . . . and that company makes no guaranty or warranty whatsoever as to quality, fitness or performance except that machinery and materials are well made, of good materials in workmanlike manner . . ."

The higher court held this guarantee void in view of the fact the A B C Co.'s venture into the air conditioning business was initiated solely as a result of the suggestion by representatives of Fairbanks Morse, that Fairbanks Morse investigated the difficulty, and made certain adjustments and repairs. This court said:

"In these circumstances, the conclusion is inescapable that Fairbanks Morse waived the guarantee by its conduct after discovery that the unit did not produce the desired results."

This court said that if the unit was inadequate in size to function in accordance with the general warranty under which it was sold, the decision would have been in favor of the A B C Company. However, as explained, failure of the unit to operate satisfactorily resulted from unusually high temperature of the city water, and the court decided that it was the duty of A B C Company to ascertain this unusual local condition.

Promise by Company Official

According to a late higher court decision a corporation is not obligated by any promise or contract made by its official, as president or vice-president, unless the testimony proves conclusively that the official positively intended to obligate the corporation.

For example, in Simon *v.* Noma Corp., 56 N. E. (2d) 537, a broker sued the Air Conditioners Sales Corp. for services which, the broker alleged, were to arrange introductions to persons or firms in a position to furnish financial assistance to the corporation. During the trial the broker testified that the vice-president of the corporation had promised to pay him 10% of the amount of any such financial assistance. The higher court refused to hold in favor of the broker, and said:

"The record contains no substantial proof that Marr (vice-president) ever intended to bind Air Conditioners Sales Corp. . . . The best that can be said for plaintiff's (broker's) proofs is that they show a deal made with Marr for 10% commission on all new moneys that should come to Marr or the corporation through plaintiff's efforts. We cannot accept that, without anything more, as sufficient basis for holding the corporation liable."

Verbal Agreement Valid

Modern higher courts consistently hold that a verbal employment contract is equally as binding as a written employment contract, if testimony is given to prove the obligations of the parties to a jury.

For illustration, in A A A Air Conditioning & Mfg. Corp. *v.* Barr, 186 S. W. (2d) 825, a lawyer sued the A A A Air Conditioning and Mfg. Corp. to recover $1,000 per month for legal services alleged to have been verbally promised him for the year 1942.

The jury was asked to decide: "Do you find from a preponderance of the evidence that the A A A Air Conditioning and Mfg. Corp. of Texas made an agreement with Burt Barr to pay him $1,000 per month in cash for legal services during the year 1942?"

The jury decided in favor of the lawyer, and the higher court approved the verdict.

Failure to Comply With State Laws

Modern higher courts consistently hold that when a corporation enters a foreign state to do business therein, such corporation impliedly agrees to become subject to the state's laws and is deemed to have notice of those laws.

For illustration, in Refrigeration & Air Conditioning *v.* Hilyard, 18 N. W. (2d) 548, reported September, 1945, it was shown that an agent of the company solicited and obtained a contract from a resident of Nebraska without complying with the statutes of Nebraska.

In a subsequent suit to collect the amount due on the contract the higher court refused to permit the air conditioning corporation to prosecute the suit. This court said:

"If a foreign corporation solicits, negotiates, or otherwise carries on business in this state contrary to local laws, and a contract growing out of such transaction is subsequently entered into and valid in another state, it will not be enforced in this state."

Foreign Corporation Cannot File Suit

A foreign corporation, in order to maintain a suit in many states must file documents of incorporation, etc., in such state.

For illustration, in R. J. Brown Co. *v.* Grosjean, 180 So. 634, a foreign corporation was denied recovery in a suit because the evidence showed that the corporation was doing business in Louisiana, and that it had failed to comply with the law entitling it to maintain its suit.

However, the incapacity of a foreign corporation which has not qualified to do business in a state to maintain its suit may be waived by the party against whom the suit was filed.

For illustration, in Hess Warming & Ventilating Co., Inc., *v.* Home Comforts Corp., 18 So. (2d) 611, the Hess Warming and Ventilating Co., Inc., an Illinois corporation, brought suit on two promissory notes in the sum of $2,500 against a Louisiana corporation. Although the former Illinois corporation had not complied with Louisiana requirements to file the suit, the higher court held that it could do so if the Louisiana corporation agreed to have the suit filed.

Not For Profit

Generally speaking, all corporations organized not for profit acquire the same status as religious bodies.

For example, in Winnetka Trust & Savings Bank

v. Practical Refrigerating Engineers, 54 N. E (2d) 253, it was shown that an unincorporated association of air conditioning and refrigerating engineers organized to promote education and enlightenment of its members. It offered no sick, disability, or death benefits.

The higher court held that it was not a "fraternal benefit association" nor an organization for profit, but was governed by substantially the same principles of law as control various religious denominations operating through unincorporated bodies.

Not Unfair Competition

The essence of unfair competition is in selling the goods of one manufacturer as those of another. Merely copying an article unprotected by patent, copyright, or trade-mark does not establish unfair competition.

For illustration, in Airolite Co. *v.* Fiedler, 147 Fed. (2d) 496, reported March, 1945, it was shown that the Ventilouvre Co., Inc., a Connecticut corporation is the wholly owned subsidiary and sales agent of the Airolite Co. The Airolite Co. sued a man named Fiedler for unfair competition and for infringement of a patent which was granted for a ventilator.

During the trial testimony showed that the Airolite Company makes and sells ventilators in varying sizes. They are frames fitted with louvers often used in doors to take the place of transoms.

The Airolite Co. prepared and submitted to the Navy drawings of ventilators which the navy put into its own specifications for vessels to be built for it. The Ingalls Shipbuilding Corp., having contracted to build certain naval vessels equipped with the ventilators of three of the drawings made by the plaintiffs, purchased the ventilators from Fiedler instead of from Airolite Co.

However, the higher court refused to hold Fiedler liable for infringement of the patent or for "unfair competition" although Fiedler used in his catalogue drawings originated by the Airolite Co. This court said:

"Unfair competition was not shown merely by the copying of the uncopyrighted drawings the plaintiffs (Airolite Co.) had made but had no exclusive right to use."

Property Owner Breaches Contract

Considerable discussion has arisen from time to time over the legal question: If one contracting party breaches his obligations does the other have a legal right to also breach his contract?

For instance, in Johnson *v.* Meiers, 164 Pac. (2d) 1012, reported February, 1946, it was shown that the Johnsons and the Meiers entered into an agreement to build a building upon the whole of a lot. The building was so constructed that a common entrance and stairway of the building served the upper story.

These two families made a written agreement whereby both families could use the entrance and stairway and a portion of the building was to be used for a furnace and air conditioning system. Later one of the families removed the furnace. In holding the family liable in damages to the other family the higher court said:

"The matter of heating the building was incidental and subordinate to the main purpose which was to have but the one building. The breach of the contract with respect to the furnace had no effect upon the right to the use of the hall and stairway."

In other words, the court held that although the family breached the contract to permit installation of the furnace in a part of the building, this fact did not give the other any right to prevent use of the entrance and stairway.

Income Tax Rule

According to a late higher court decision the extra cost to a taxpayer of radical changes in plans of a building are part of the cost of the building, and are not deductible as losses for income tax purposes.

For illustration, in Driscoll *v.* Commissioner of Internal Revenue, 147 Fed. (2d) 493, reported May, 1945, it was shown that while constructing a hotel building a part of the air conditioning system as fans, motors, and other material were removed because the owner concluded that some radical changes should be made in the plans and size of the building, and that the air conditioning system was inadequate. Considerable work had been done and materials used which had to be torn out in making these changes. The cost of the changes in air conditioning and plumbing, together with additional fees to architect and contractor was $61,160.70.

The owner claimed this amount as a "deduction" from his income tax. The higher court refused to allow this amount as a deduction, saying it was part of the cost of the building.

Repairman Recovers Damages

Considerable controversy has existed from time to time regarding the right of machinist or repairman to recover damages from property owners for injuries sustained while making repairs on air conditioning machines.

Modern higher courts hold that a person while repairing a machine does not assume the risk of the dangerous condition of a machine which he is to repair.

For instance, in Atlanta Enterprises, Inc., *v.* James, 24 S. E. (2d) 130, it was shown that a repairman sued the owner of a theater to recover damages for injuries when the cylinder pressure of an air conditioning machine caused the stuffing to be violently thrown against a metal plate which the repairman was removing after he had unscrewed the stuffing box.

The repairman testified that the owner of the theater told him that the machine was not in operation, and had not been for several weeks.

In holding the theater owner liable, the higher court said:

"If Brand (theater owner) had had reason to believe the machine contained gas it would have amounted to negligence for him to permit James (repairman) to begin his work before the gas was drawn off and the cylinder relieved of pressure."

Graphical Determination of Heat Transfer Film Coefficient for Freon-113*

B. F. RABER** and F. W. HUTCHINSON***

THE film coefficients for liquid Freon-113 are substantially less than the corresponding coefficients for Freons 11, 12, 21, and 22 (refer to articles in HEATING AND VENTILATING for June '45, April '45, April '46, and May '46). This is largely due to the fact that the viscosity of F-113, in the temperature range considered, is much greater than for any of the other Freons. Fig. 17 is a graphical solution for *liquid* refrigerant flowing through a pipe and gaining or losing heat *without changing state.* It should be emphasized that all solutions so far presented (water, ammonia, sulfur dioxide, brine in the December '44, and January, February, March 1945 issues of this magazine and the four Freons as indicated above) are for liquid which is neither evaporating nor condensing: these latter cases represent special heat transfer problems which will be given detailed consideration in later installments of the series.

Fig. 17 shows that the film coefficient for Freon-113 increases progressively as the temperature increases from 0F to 100F. The coefficients for fluid cooling are substantially less than for heating, the lines for cooling being shown dashed in the figure. Use of Fig. 17 is the same as use of the 16 previous graphs except that for cooling fluid at temperatures less than 75F the temperature correction would be obtained by moving vertically *down* from the base scale to the horizontal corresponding to the particular temperature then returning upward along a temperature directrix line to intersection of the base scale at the value of the film coefficient of heat transfer.

Fig. 18 is for liquid flowing outside and normal to a single pipe. The method of using the figure is illustrated by a dashed line.

Example: To determine the film coefficient for refrigerant flowing at a velocity of 4 fps across a 1½-in. outside diameter tube, the fluid temperature being 75F. As shown by the dashed line, the resultant film coefficient will be found as 188 Btu per hr per sq ft of outside pipe surface per degree Fahrenheit temperature difference between the fluid and the pipe surface.

This Heat Transfer Series

This article is the ninth in a series concerned with the graphical evaluation of film coefficients for fluids important in the fields of refrigeration, heating, and air conditioning. All of the solutions so far presented have been for fluids heating or cooling (but not evaporating or condensing) in the liquid state. Additional articles are planned for the series and the Editor will gladly receive comments and suggestions concerning additional fluids which may be of particular interest to some groups of readers.

(A) A summary of the heat transfer theoretical and empirical relationships which have so far been presented is as follows:

1. All graphical solutions for fluid *heating* inside a pipe are based on the equation,

$$h_i = 0.0225\ (V^{.8})\ (D^{-.2})\ (\rho^{.8} k^{.6} c_p^{.4} \mu^{-.4})$$

2. All graphical solutions for fluid *cooling* inside a pipe are based on the equation,

$$h_i = 0.0225\ (V^{.8})\ (D^{-.2})\ (\rho^{.8} k^{.6} c_p^{.3} \mu^{-.5})$$

3. All graphical solutions for fluid heating or cooling outside and flowing normal to a single pipe are based on the equation,

$$h_o = 0.385\ (V^{.56})\ (D^{-.44})\ (\rho^{.56} k^{.7} c_p^{.3} \mu^{-.26})$$

In the above equations h_i and h_o are the inside and outside film coefficients of heat transfer respectively; V is fluid velocity in feet per second; D is pipe diameter in feet (inside or outside depending on whether solving for h_i or h_o); ρ, k, c_p, and μ are, respectively, the density, thermal conductivity, specific heat, and viscosity of the fluid.

(B) Graphical solutions of h_i and h_o for nine fluids have been given in the articles of the series: water (December '44), ammonia (January '45), sulfur dioxide (February '45), brine (March '45), Freon-12 (April '45), Freon-11 (June '45), Freon-21 (April '46), Freon-22 (May 46), Freon-113 (June '46).

(C) Discussions of the conditions under which the base values of h_i and h_o can be used for more complex types of flow have been given as follows:

(1) Flow in annular spaces. Use the graph for h_i with a diameter calculated from the equation,

$$d = (d_o^2 - d_i^2)/(d_i)$$

where d_i and d_o are the inside and outside diameters of the annular space.

(2) Flow outside and parallel to the tubes of a tube bundle. Use the graph for h_i with $d = d_s^2/(Nd_t)$ where d_s is the shell diameter and d_t the tube diameter and N the number of tubes in the bundle.

(3) Flow through pipes of non-circular cross-section. Use graph for either h_i or h_o, as dictated by conditions, and take equivalent diameter of pipe as equal to four times the area of the actual cross-section divided by the perimeter.

(4) Flow outside and normal to a tube bundle. If tubes are staggered, use 130% of the h_o obtained for graph with V corresponding to its maximum value. If the tubes are parallel, use the value of h_i for a single tube as determined with V at its maximum value.

(D) Simplification of the problem of determining overall heat transfer rates has been achieved by means of five tables, one for each of five kinds of pipe and tube. The heat transfer expressed in Btu per hour per lineal foot of pipe is given by an equation of the form,

$$q = \frac{\Delta t}{\frac{1}{h_i \pi d_i} + \frac{d_o - d_i}{k\pi(d_o + d_i)} + \frac{1}{h_o \pi d_o}} = \Delta t/(r_i + r_p + r_o)$$

Where q is heat transferred, Δt is temperature difference, r_i is inside film resistance, r_o is outside film resistance, r_p is pipe wall resistance, and other symbols are as previously given.

Table 1 (Jan. '45) is for standard wrought iron or steel pipe and gives values of r_i and r_o in terms of h_i and h_o; values of r_p are also given. Tables 2, 3, and 4 give r values for Types K, L, and M tubing whereas Table 5 (June '45) is for extra heavy pipe.

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*"Freon" is a copyrighted trade name held by Kinetic Chemicals Co.

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***Professor of Mechanical Engineering, Purdue University, Lafayette, Indiana.

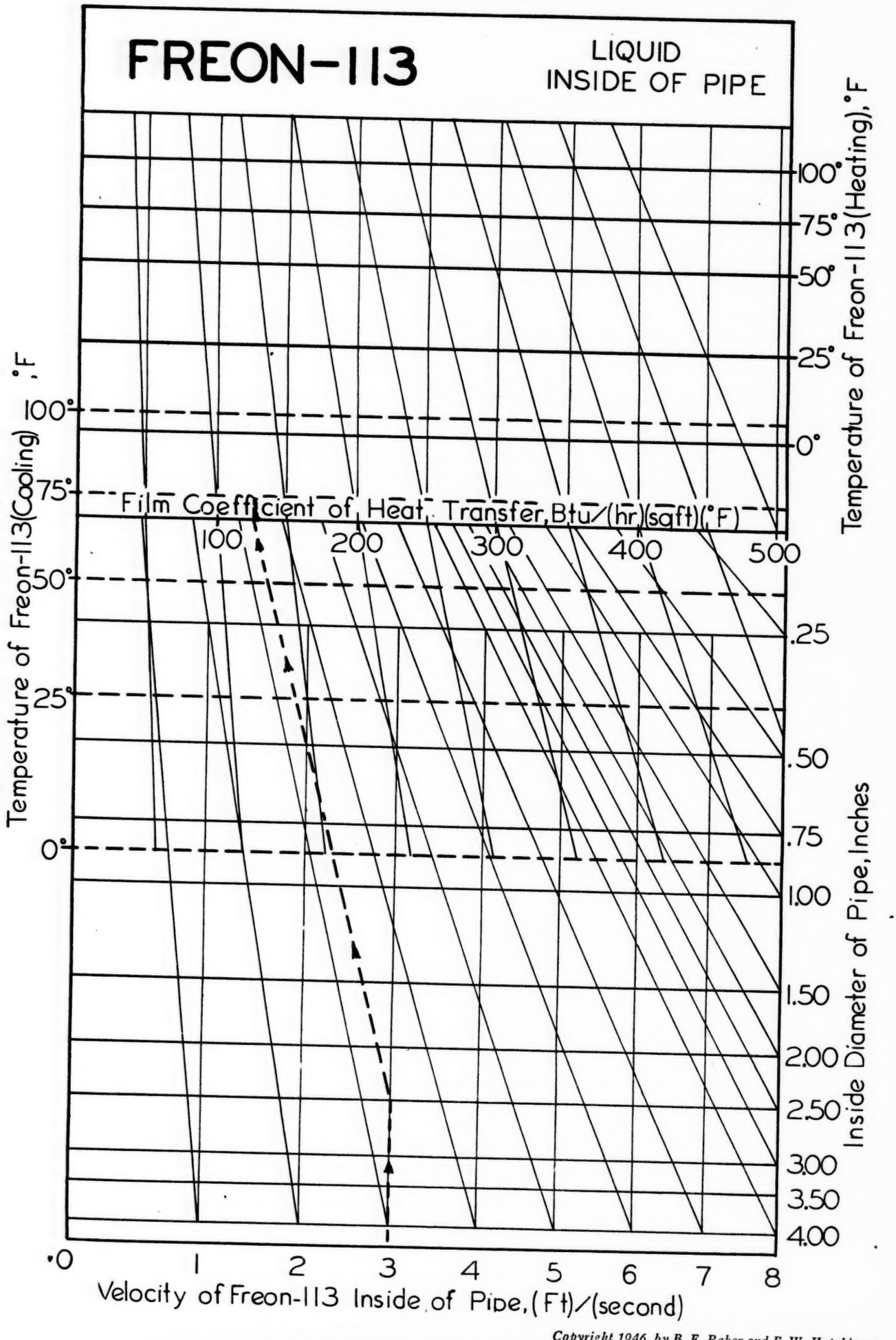

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Fig. 17. Film coefficient for liquid Freon-113 flowing inside a pipe.

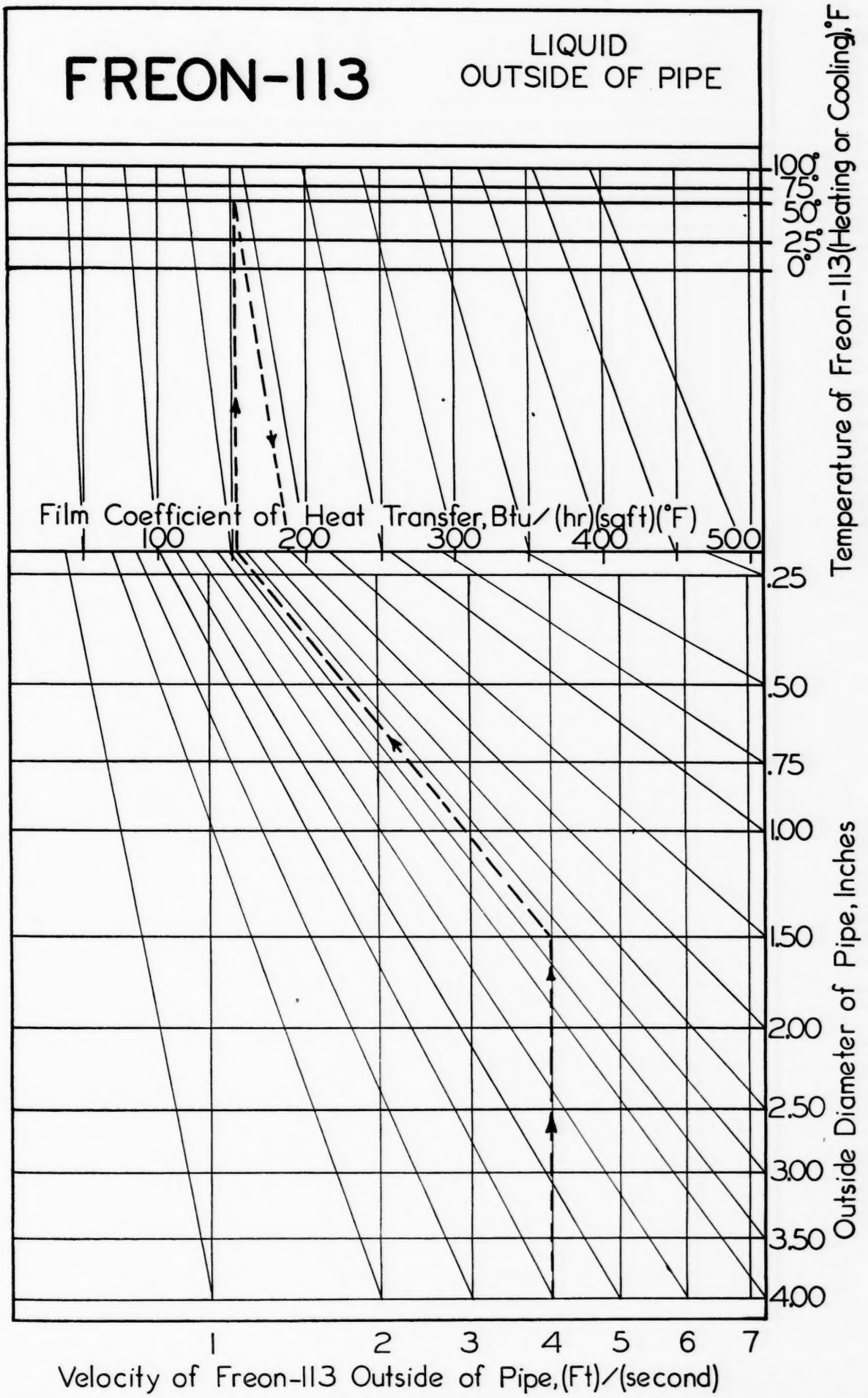

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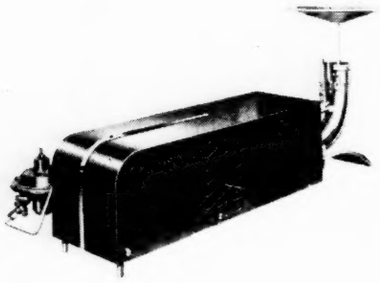
Fig. 18. Film coefficient for liquid Freon-113 flowing outside a pipe.

NEWS OF EQUIPMENT AND MATERIALS

Gas Burner

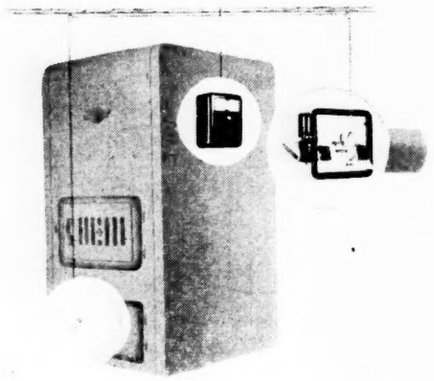
NAME—Norgas conversion burner.
PURPOSE—For converting domestic furnaces and boilers to use of gas.
FEATURES—Constructed of heavy gage sheet steel, electrically welded, it has approval of the AGA. Unit is shipped complete in carton with illustrated installation manual and can be completely assembled outside the furnace. Burner can be ex-



tended to accommodate firepots from 14 to 30 in. or more in diameter. Pilot extends with the burner head. Adjustments for primary and secondary air control are made outside the burner.
MADE BY—*Norman Products Co., Inc., 1150 Chesapeake Ave., Columbus 8, Ohio.* 24

Heating Equipment Control

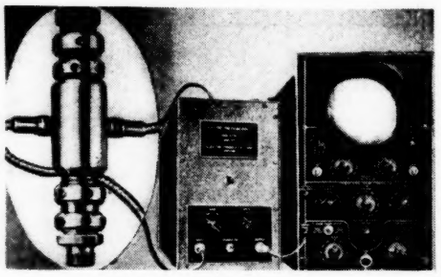
NAME—Perfex 4-point control system.
PURPOSE — Automatic control and



protection for a hand fired space heating system.
FEATURES—System includes Magic Dial Control of room temperature; automatic protection against overheating; automatic control of fuel burning rate; and automatic control of heat loss at the chimney. System has a thermodraulic chimney draft and damper regulator which regulates the supply of air to the burning fuel at a rate for proper combustion and prevents runaway fires. When the thermostat is satisfied, draft is further checked and the fire automatically banked. The system is set to suit draft to the type of fuel used, size of heating plant, and outdoor conditions. It can be installed on any warm air, hot water or steam heating plant.
MADE BY — *Perfex Corp., 500 W. Oklahoma Avenue, Milwaukee 7, Wisconsin.* 25

Pressure Recorder

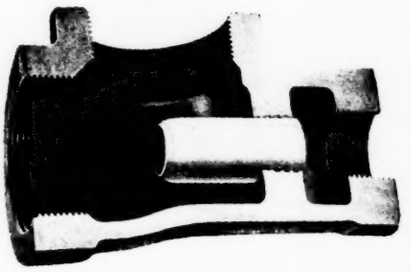
NAME—Pressuregraph.
PURPOSE—Electronic instrument to



indicate pressure variations of engines and pumps.
FEATURES—The cathode ray oscillograph provides a linear pressure-time curve to indicate the performance of any engine or pump subject to pressure variations. In addition to dynamic pressure variations it shows static or slow pressure changes and covers all mechanical speeds and pressures up to 10,000 lb per sq in. The pickup includes a diaphragm which, when acted on by pressure impulse, unbalances an electronic circuit. The unbalanced voltage is delivered to the electronic amplifier and then to the oscillograph.
MADE BY—*Electro Products Laboratories, 349 W. Randolph St., Chicago 6, Ill.* 26

Flow Control

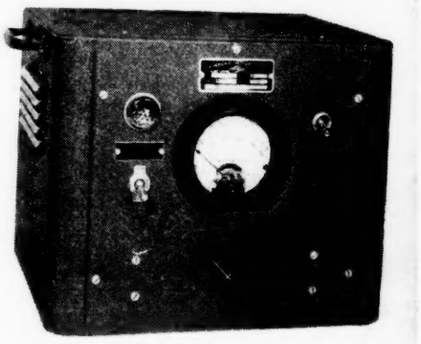
NAME—Taco Flo-Jet.
PURPOSE—Control of water flow in an indirect heater system.
FEATURES—The heavy copper venturi jet is permanently expanded into the cast iron body and is tested to withstand 80 lb hydrostatic pressure. This jet is intended to insure the flow of water in the proper direction so that more



efficient water heating results. Full throat construction around the expanded copper tube jet permits unrestricted gravity boiler water circulation when the circulator is off.
MADE BY—*Taco Heaters, Inc., 342 Madison Avenue, New York 17, New York.* 27

Electric Hygrometer

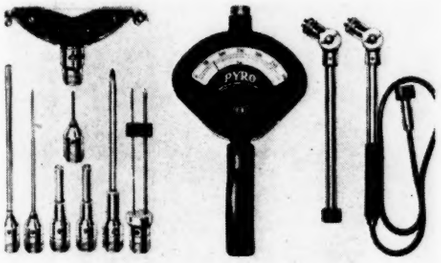
NAME — Aminco-Dunmore electric hygrometer.
PURPOSE—For high precision humidity measurement and control.
FEATURES — The instrument gives reproducible readings through the entire standard dry-bulb temperature range of 40 to 120F and rela-



tive humidity range of 7 to 100%. Changes within plus or minus 0.5% relative humidity are instantly indicated and recorded.
MADE BY — *American Instrument Co., Silver Spring, Md.* 28

Pyrometer

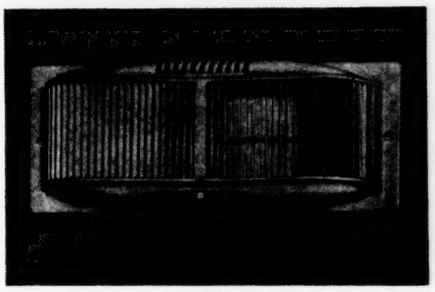
NAME—Pyro surface pyrometer.
PURPOSE—Self-contained pyrometer set for large temperature range measurement.
FEATURES—Unit is self-contained portable and compact. It is housed in a moisture and dust proof shielded steel box that is immune to external magnetic influences. An internal automatic cold end junc-



tion compensator is standard equipment with this instrument. There is a choice of eight different thermocouples and two types of extension arms all interchangeable without adjustment or re-calibration. Pyrometer has a selection of five different temperature ranges from 0 to 300F to 0 to 1200F. All thermocouple wires are checked to an accuracy of plus or minus 2F.
LITERATURE AVAILABLE—Catalog 160.
MADE BY—*The Pyrometer Instrument Co., 103 Lafayette St., New York 13, N. Y.*.....29

Grille

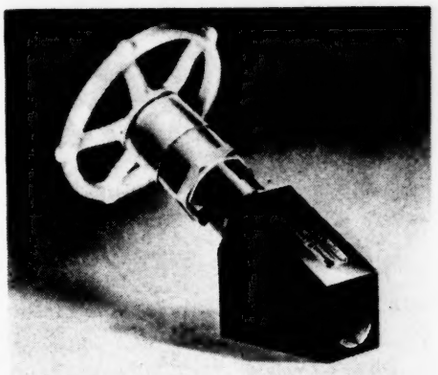
NAME—Grad-U-Flow register.
PURPOSE—Warm air distribution.
FEATURES—Warm air supply is controlled by self-contained system which regulates dampers to provide more or less heat in accordance with demands. Once temperature selection is made, device keeps it to the point selected. Register motor consists of a remote temperature bulb, a bellows and a lever which positions the dampers to maintain the required temperature.
OPERATION—In operation the bulb is mounted under a cover on the front of the grille, reacts to changes in temperature of the induced air from the room, and causes the bel-



lows to either expand or contract. A system of levers attached to the bellows opens or closes the dampers in direct or immediate response to room temperatures. Control setting is a screw-mechanism which alters the balance point of the levers.
MADE BY—*Minneapolis-Honeywell Regulator Co., 2753 Fourth Ave., So., Minneapolis 8, Minn.*.....30

Angular Globe Valve

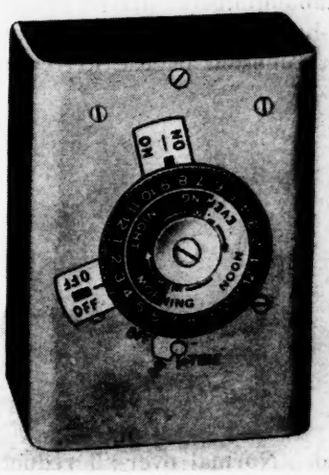
NAME—Grove series V and VL valves.
PURPOSE—Globe valve use.
FEATURES—Solid one-piece stem and nut is used to provide tight shut-off when closed. Valve stem is not directly carried by the hand wheel and therefore avoids any chance of stem being distorted or bent. Makers claim reduced friction loss and turbulence. Shocks are absorbed by a multiple full threaded section of the hand wheel



and yoke. Sealed lubricant is zoned entirely away from the flow stream and is isolated from temperature changes to increase its life. This valve design is provided in 30° and 90° angle pattern.
LITERATURE AVAILABLE—Bulletin 5060.
MADE BY—*Grove Regulator Co., 65th and Hollis Streets, Oakland, California.*.....31

Time Switch

NAME—Comfortrol.
PURPOSE—Control of automatic operation of ventilating fans and electrical appliances.
FEATURES—Unit consists of a precision clock and switching device designed for predetermined on and off operation of ventilating fans. It provides complete automatic operation of on-off cycle every 24 hours.



Manual operation does not interfere with automatic cycle.
MADE BY—*Holcomb & Hoke Mfg. Co., Inc., Indianapolis, Ind.*.....32

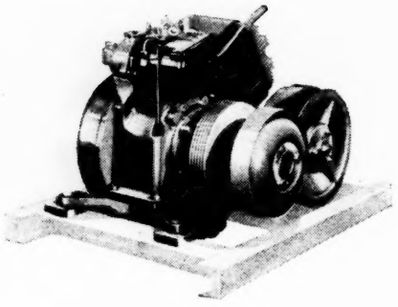
Water Heater

NAME—Evans oil-burning water heater.
PURPOSE—General hot water service.
FEATURES—Model uses an Allen type burner. Unit is finished in baked white enamel with black trim and uses rock wool and dead air space as insulation. It is listed as standard by Underwriters' Laboratories for use with No. 1 and No. 2 fuel oil.

SIZES AND CAPACITIES — Units available in 20, 30 and 40 gallons.
MADE BY—*Evans Products Co., 15310 Fullerton Ave., Detroit 27, Mich.*.....33

Power Package

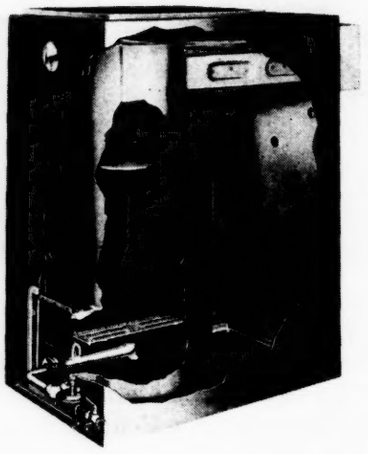
NAME—Salsbury automatic transmission.
PURPOSE—Varying drive for power transmission.
FEATURES—An automatic driving unit for the low horsepower field in which the drive ratios are controlled by the driven unit and clutch engagement is controlled by engine speed. Transmission consists of a variable diameter drive pulley, a variable diameter driven pulley and a V-belt. Drive ratio is controlled as a function of the driven shaft



speed. Normal over-all reductions may range from 4-to-1 to 1-to-1 for light duty, high speed units; from 200 to 1 to 50 to 1 for heavy duty requirements. Makers claim that the V-belt used has a normal life of from 1,000 to 3,000 hr. The engine is a single-cylinder four-cycle air cooled type developing 6½ hp at 3,200 rpm and weighs 56 lb.
MADE BY—*Salsbury Motors, Inc., 4464 District Blvd., Los Angeles, Calif.* **34**

Domestic Heating Unit

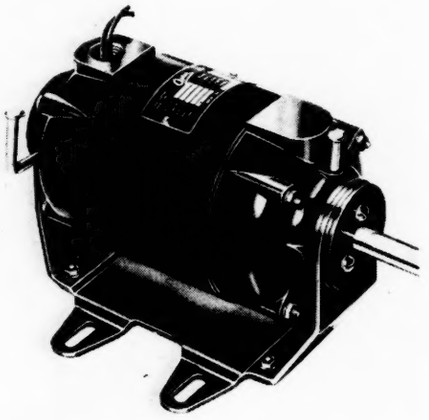
NAME—Bryant steel furnace.
PURPOSE—Steel gas-fired domestic heating unit.
FEATURES — Unit is available for gravity or forced-air systems. The design has almost eliminated flat surfaces and has done away with noises during the warming-up and cooling periods. Combustion chamber and heat exchanger have been arranged in an updraft layout to avoid entrapment of condensate and resultant corrosion in the exchanger tubes. Axial burner is said to prevent hot spots in combustion chamber. Easy access to the heat-



ing elements simplifies cleaning. Heating units are completely packaged and are door size to facilitate installation.
SIZES AND CAPACITIES — 70,000, 90,000, 120,000 and 140,000 Btu per hr.
MADE BY — *Bryant Heater Co., Cleveland, Ohio.* **35**

Electric Motor

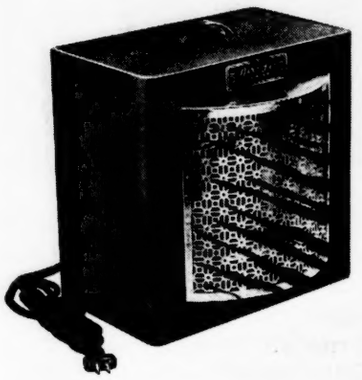
NAME—Ostermotor.
PURPOSE—Continuous-duty motor.
FEATURES—Split phase induction,



continuous-duty model, operates on 115 volts a-c. The motor is totally enclosed. The bronze sleeve bearings are grooved for oil distribution. Oversize felt oil retainers feed oil to shaft through two spring tension wicks at each bearing. Neoprene motor mountings absorb vibration. Flange mounting is available if desired.
MADE BY—*John Oster Mfg. Co., Racine, Wis.* **36**

Electric Heater

NAME—Air-Flo electric heater.
PURPOSE—Space heating.
FEATURES—A portable electrically operated room heater in which combination forced air and heat-radiant are enclosed in a wrinkled finish, sheet metal case. Structural features of the fan and tunnel, through which the air passes across the heating coils, protect the case from becoming hot. Makers claim it will raise the temperature of an



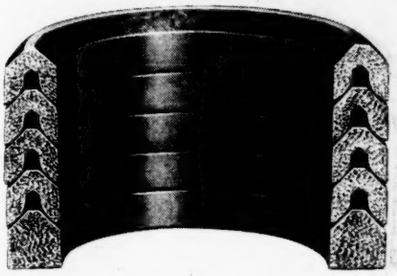
average size room from 50F to 70F in 18.5 minutes. It operates on 120 v a-c and consumes 1320 watts. Product has the approval of the Underwriters' Laboratories.
SOLD BY—*Acme Brands, Inc., 644 Broadway, New York 12, N. Y., sole factory representative.* **37**

Insulating Material

NAME—Fiberglas superfine PF Insulation.
PURPOSE—Light insulating material for trucks, railroad cars, etc.
FEATURES—Fibers are treated with a thermosetting binder and shaped into half-inch thick sheets which are available in 48- and 54-in. widths. Density is 0.6 lb per cu ft. Material comes in 50-ft rolls. Thermal conductivity of sheets is said to be 0.26 Btu per sq ft per hr per in. per F temperature difference. Material also has acoustical properties. This insulating material is the result of war research and was developed for military aircraft.
MADE BY—*Owens-Corning Fiberglas Corp., Toledo, Ohio.* **38**

Packing Ring

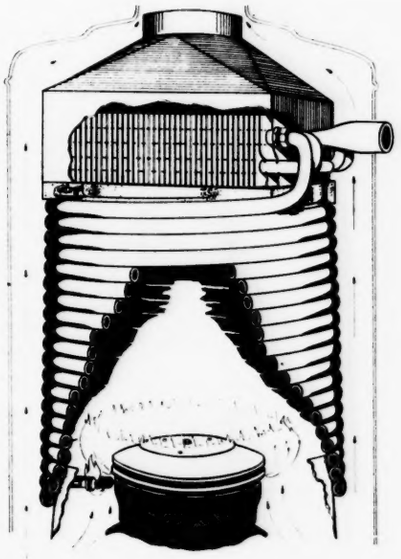
NAME—Palmetto pyramid packing.
PURPOSE—For general packing use requiring heavy wear.
FEATURES—Bottom ring of packing receives the full impact of the power stroke and it expands the wedge-shaped lip of each ring above it so that the packing is pressed against both the rod and wide walls. Binding is prevented by in-



filtration of fluid between the rings and the storage of fluid in the arrowhead reservoir. Ease of operation is assured by the curved design of the interior lip surface which also prevents friction within the packing. No special adapter ring is required since the top ring has a flat top surface and 45° angle surfaces that accommodate any standard shape gland - follower. Packings may be used in any stuffing box, for rotary as well as reciprocal action.
MADE BY—*Greene, Tweed & Co., Bronx Blvd. at 238th St., New York 66, N. Y.* **39**

Water Heater

NAME — SMITHway - Burkay instantaneous gas water heater.
PURPOSE—Generation of domestic hot water at two different temperatures.
FEATURES—Heater has a capacity of from 190,000 to 195,000 Btu per hr, heating 125 gal of water from 50 to 180 degrees in an hour or 3,000 gal of 180-degree water in a day. Unit is said to deliver hot water within two degrees of thermostat setting through air control which increases or decreases the gas supply as the flow of water varies. The burner provides two stages of primary air and an auxil-



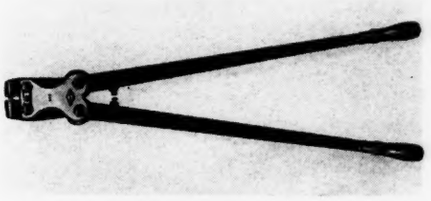
iary supply of secondary air to insure combustion of gases that might otherwise be unburned. There is a heat exchanger in which multiple metal fins surround and support the tubing. Where 180° sterilizing water is needed and normal hot water up to 140F is required, both may be supplied at the same time. The heater maintains 140F water in a tank from which it can be drawn as desired but when sterilizing water is needed the heater also draws from the tank and boosts the water to 180F.
MADE BY—*A. O. Smith Corp., Milwaukee, Wis.* **40**

Colorimeter

NAME—Lumetron photoelectric colorimeter Model 450.
PURPOSE—For trace analysis of water samples and extracts where a slight coloration can be developed in testing.
FEATURES—Main application of instrument is in the field of water testing where it can be used for making turbidity analysis and in other tests dependent on reagent colorations of samples tested. Makers claim that instrument is sensitive to very small amounts of foreign matter in water. Instrument can be operated either from 110 a-c or from an automobile type storage battery.
MADE BY—*Photovolt Corp., 95 Madison Avenue, New York 16, New York.* **41**

Button Punch

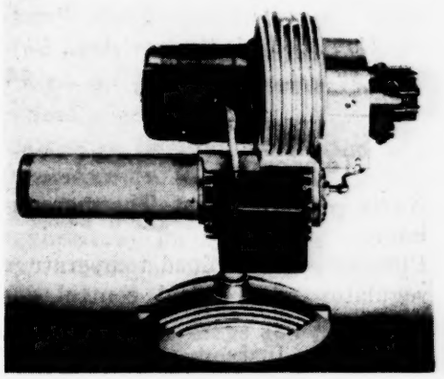
NAME—Helwig button punch.
PURPOSE—Stamping sheet metal.
FEATURES—Patented geared handle permits smooth operation by hand pressure. Two styles of jaws are provided—one straight and the other at 45° angles. Tool can be used parallel with and close to the metal seam. Jaws are held by two specially tempered steel plates.
SIZES AND CAPACITIES—Made to punch holes from $\frac{1}{8}$ to $\frac{3}{8}$ in.



MADE BY—*Helwig Mfg. Co., Inc., 422 E. Seventh St., St. Paul 1, Minn.* **42**

Oil Burner

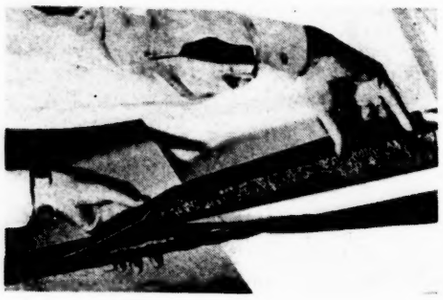
NAME—Model HE-1.
PURPOSE—General use as fuel oil burner.
FEATURES—Unit can fire from $\frac{3}{4}$ to 3 gal of oil per hour and is powered by a 1/6 hp a-c motor. Has thermal overload protection. Ignition is obtained by a 10,000-volt



heavy duty transformer with built-in radio interference suppressor. A swirling air-flow feature plus a dual flame adjustment permits regulation to desired flame shape. Nichrome steel electrodes provide hot spark at the proper gaps.
MADE BY—*HomEase Products Division, Bogue Electric Co., 7000 Iowa Ave., Paterson 3, N. J.* **43**

Pipe Covering

NAME—Mystik Self-Stik Dri-Pipe.
PURPOSE—Prevention of drip from cold water pipes.
FEATURES—A protective insulating material is placed on a waterproof backing cloth which has an adhesive edge. This covering is installed lengthwise on the pipe and can be cut to fit conditions. Once installed, no painting or other covering is required. The moisture-proof resinous-coated cloth prevents dampness from damaging the



soft, pliable insulating material on the inside. Covering can also be used for cold air ducts and constant temperature tanks.
SIZES AND CAPACITIES—Made in one size for covering ½- and ¾-inch pipe. Larger sizes can be obtained by splicing necessary widths together. Larger sizes and greater thickness of insulating material available for industrial uses.
MADE BY—*Mystik Adhesive Products, Div. of Chicago Show Printing Co., 2635 N. Kildare Ave., Chicago 39, Ill.* **44**

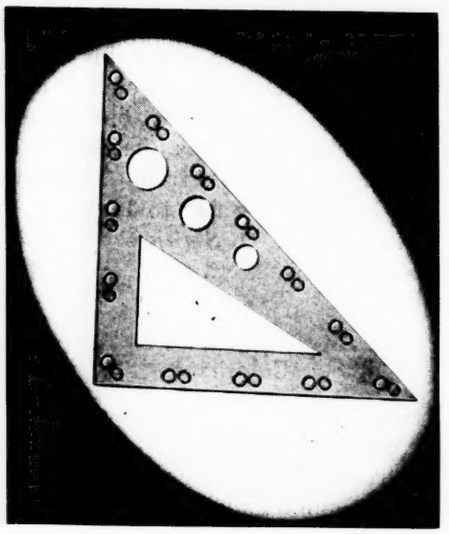
Temperature Regulator

NAME — Mercuroplat Thermoregulator.
PURPOSE — Combined temperature regulator with signal control device.
FEATURES—Instrument is intended for control of temperatures within the setting range of —30F to 500F. Signal light is illuminated while temperature is rising and shuts off when the pre-determined setting is reached. Signal is designed to inform the operator when the desired temperature setting has been attained. Instrument has machine plastic head and a special mounting for the signal light.

SIZES AND CAPACITIES — Thermoregulator is available in 6, 8, 10, and 12-in. lengths.
MADE BY—*Washington Glass Laboratory and Instrument Co., 3224 Georgia Ave., N.W., Washington 11, D. C.* **45**

Floating Triangle

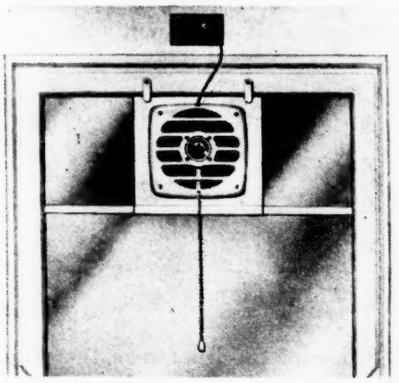
NAME—Instrumaster floating triangle.
PURPOSE—General drafting use.



FEATURES—Integral embossed buttons on the triangle enable it to clear the paper by about 0.02 in. This permits draftsman to lift the triangle from the board with greater ease and also reduces the amount of smudging from moving the triangle over the drawing. The feature of the triangle is that it serves as a 45 and also as a 30-60 degree triangle. It is available in sizes from 4 to 12 in.
MADE BY—*Instrumaster Industries, Inc., Greenwich, Conn. Distributed by John R. Cassell Co., Inc., 110 W. 42nd St., New York 18, N. Y.* **46**

Ventilating Fan

NAME—Victron V-186-W.
PURPOSE—Ventilator for use in homes with wood sash windows.
FEATURES—Fan may be installed in any wood sash type window where installation through the wall is impractical. Flush mounting assures no interference with shades, blinds, or window action. Unit may be re-



moved and taken from one house to another. It delivers 450 cfm and motor does not cause radio interference. Motor, blade and grille are easily removed for cleaning.
MADE BY—*Victor Electric Products, Inc., 2950 Robertson Ave., Cincinnati 9, Ohio.* **47**

Sealing Caps

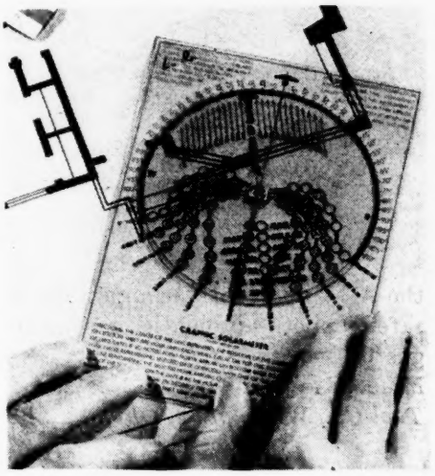
NAME—G-E plastic sealing cap.
PURPOSE—For sealing ends of tubes as condenser systems of refrigerators and air conditioning systems.
FEATURES—Sealing caps and sleeves are made in a number of colors. They are water resistant and have good electrical properties. To use, the caps are swelled by soaking in G-E dilater No. 12501. Caps are applied in the swollen state and in drying shrink to a tight fit.
MADE BY—*General Electric Co., 1 Plastics Ave., Pittsfield, Mass.* **48**

Faucet Washers

NAME—Hapco washers.
PURPOSE—For all water faucets.
FEATURES—Made from nylon. Are claimed to provide a soft, long-life seal, thus eliminating some of the washer replacements.
MADE BY—*Hall Products Co., Clifton, N. J.* **49**

Solar Data

NAME—Graphic Solarmeter.
PURPOSE — For determining direction of sun's rays at various hours of day and seasons of year.
FEATURES—Transparent meter with transparent revolving disc can be placed directly on drawing, and after pointing arrow to north on plan and setting disc, direction of sun rays will be found for hour and date selected. Can be used to determine how far sunlight will enter a room at a given time. A separately designed solarmeter is made



for each 2.5 deg. band of latitude throughout the United States or a band 175 miles wide. Instrument is claimed to be accurate to within 3 deg. within the area specified.
MADE BY—*R. W. Justice, Belvedere, Marin County, Calif.* 50

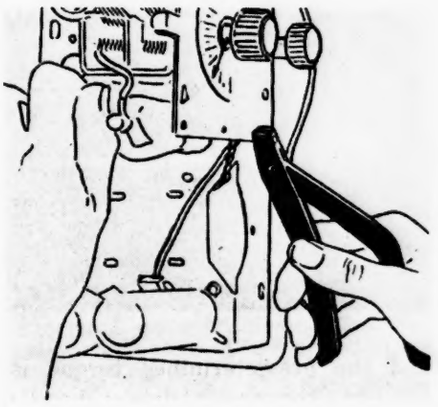
Baseboard Radiator

NAME—Radi-Vector.
PURPOSE—A convector that extends along the baseboard of a room to be used in place of conventional radiators.
FEATURES—Special Radi-Vector design has fins 2 in. by 4¼ in. bolted to a 1 in. seamless pipe to permit recessing into the wall at baseboard. For commercial and industrial use, convector is made from standard 2 in. seamless steel pipe with steel fins 4¼ in. square. Heating surface is 5¼ sq ft per lineal foot. Pipe is either furnished threaded or chamfered for welding. Convector is also made from

1¼ in. pipe having 3¼ in. square fins and a heating surface of 4¼ square feet per lineal foot. Also supplied with a 1¼-in. copper tubing with 3¼-in. square fins of copper alloy. Two types of grille covers are applied, one with diagonal mesh design which encloses the top and front of industrial and commercial radiators and the other which has a solid metal front and a perforated top for use with Radi-Vector.
MADE BY—*The Vulcan Radiator Co., 26 Francis Ave., Hartford, Conn.* 51

Blind Rivet Gun

NAME—Cherry Jr. riveter.
PURPOSE—For small blind rivets.



FEATURES—Junior riveter is a plierlike tool that installs the Cherry type of blind rivet with a simple pull. It is made for small fastening jobs that occur in many shops. Gun installs a 3/32 in. Cherry type blind rivet available in three grip lengths.
MADE BY—*Cherry Rivet Company, 231 Winston St., Los Angeles 13, Calif.* 52

Window Type Fan

NAME—Emerson window type cooler fan.
PURPOSE—To provide rapid air circulation for small spaces.
FEATURES—Twenty inch fan has a capacitor motor for quiet operation, blades are formed from sheet aluminum and fan has a capacity of exhausting 3,500 cfm in free air. Cab-

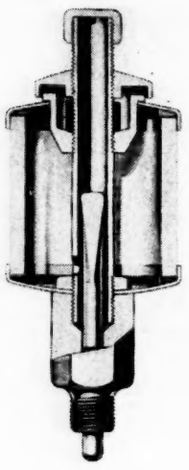
inet dimensions are 24 in. wide by 9 in. deep by 24 in. high. It can be mounted in any window with a minimum opening of 20 in.
MADE BY—*The Emerson Electric Manufacturing Co., St. Louis, Missouri.* 53

Oiler

NAME—Oil-Rite DOSF sight gravity feed oiler.
PURPOSE — General lubrication of machines.
FEATURES—Rate of oil flow can be regulated by an adjustable needle valve through the turning of a knurled cap. A shut-off valve on top of the oiler stops the oil flow. Oil supply is visible through Lucite reservoir. Bottom is so designed that dirt and foreign matter will settle on a surface lower than the oil intake port leading to the needle valve. Oiler is easily taken apart for cleaning.
SIZES AND CAPACITIES—Made in 9 sizes from capacities of ⅝ oz to 1½ qt.
MADE BY—*Oil-Rite Corp., 3473 S. 13th St., Milwaukee 7, Wis.* 54

Bottle Oiler

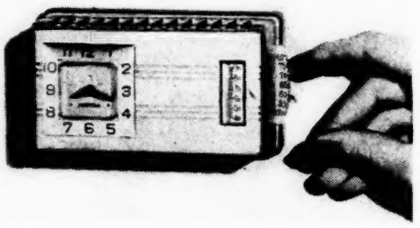
NAME—Vibrating rod bottle oiler.
PURPOSE—Lubrication of sleeve and line shaft bearings.
FEATURES—Unit consists of brass and lucite. Bottom shank can be attached to bearings by pipe thread connections. A filler cap closes the reservoir but permits replenishing of oil supply. Oil supply is always visible through the lucite container.



OPERATION—Oil is fed from an air-tight reservoir through an oilport to a feed rod which slides in a closely fitted hole in the base and rides lightly on the journal. A slight vibration is caused by the directional drag of the rotating shaft on the feed rod and this results in a pumping action.
SIZES AND CAPACITIES — Available for ½, 1, 2, 4, 8, 16, and 32 oz and comes with ⅛, ¼, ⅜ or ½-in. pipe thread.
MADE BY—*Oil-Rite Corp., 3473 So. 13th St., Milwaukee 7, Wis.* **55**

Temperature Control

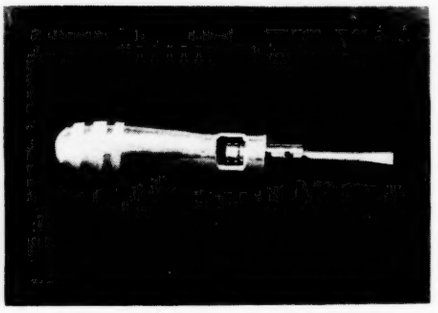
NAME—Chronotherm.
PURPOSE — Automatic temperature control.
FEATURES — Although the name Chronotherm is not new with the company, instrument has new external and interior design. It provides time settings for day and night temperatures that are easily set on a one-quarter hour scale. A new type bimetal element has been



developed for this instrument to provide accurate temperature control. Additional electrical mechanism prevents overshooting the daytime temperature setting during the morning pickup. Clock is of a self-starting type employing a low speed motor to eliminate noise. Instrument permits adjustment of temperatures to as low as 50F for the time when occupants are away from the home.
MADE BY — *Minneapolis-Honeywell Regulator Company, Minneapolis, Minnesota.* **56**

Screw Drivers

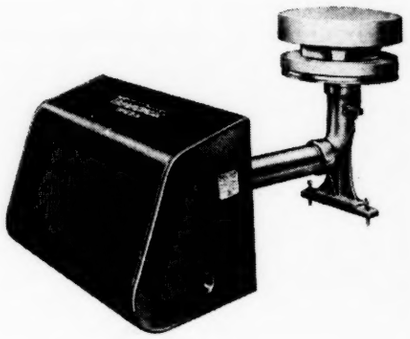
NAME—Tru-Torque screw drivers.
PURPOSE — For general precision service.
FEATURES—Screw driver is pre-set at the desired torque. When the operator tightens the screw or nut



and the pre-determined torque is reached, the screw driver handle slips and no further tightening of the screw is possible. Tool comes complete with one regular blade for slotted screws or nuts, one Phillips-type blade, one Allen wrench and pin setter. Tool is also supplied with sealed torque setting as well as special torque measuring equipment.
MADE BY — *Airdraulics Engineering, Inc., New Canaan, Conn.* **57**

Gas Burner

NAME—Thermomatic universal gas conversion burner.
PURPOSE — For converting home heating units to the use of gas.
FEATURES—In installing this unit no cementing or brick work is necessary and the unit can be removed with the same ease with which it was installed. It is fully automatic and controlled by a room thermostat. The burner has approval of



the AGA and contains an automatic safety pilot, automatic gas valve, gas pressure regulator.
MADE BY—*Willoughby Machine & Tool Co., Willoughby, Ohio.* **58**

Electrode Holders

NAME—Twecotong holders.
PURPOSE—For holding the various electrodes used in welding.
FEATURES—Conventional tong type holder has molded-laminated glass cloth insulation keyed to the holder casting. The spring seats on fibre upset washers and is protected from

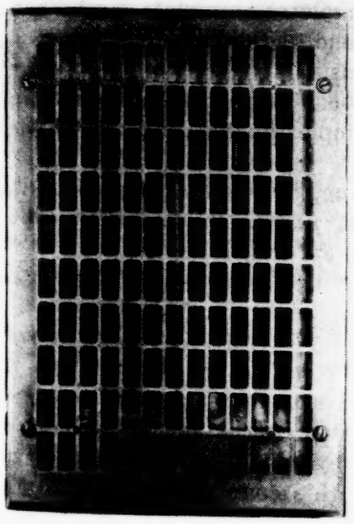
spatter by non-binding Neoprene tubing. Handle is of fibre and all parts are replaceable.
SIZES AND CAPACITIES—Model No. A-14, 300 amps, ¼-in. electrode capacity; A-38, 500 amps, ⅜-in. electrode, and semi-insulated models of 300 and 500 amps capacity.
MADE BY — *Tweco Products Co., Wichita 7, Kans.* **59**

Electric Wall Heater

NAME—Hy-temp electric radiant wall heater.

PURPOSE—For general room heating.

FEATURES—Heater is enclosed in a heavy steel casing and fits flush with the wall. It has nichrome wire twin heating elements in a highly polished reflector. The grill is made



either of aluminum or chromium plate.

SIZE AND CAPACITY—Unit measures 12 x 18 x 4 in. and operates on 1500 watts.

MADE BY—*Hydro-Aire, Inc., 626 N. Robertson Blvd., Los Angeles 46, Calif.* **60**

Flow Gauge

NAME—Builders Flo-Gage, model FGG.

PURPOSE—Rate of flow indicator for lines carrying water, steam or air.

FEATURES—Unit requires very little space, is easy to install, and requires no mercury or auxiliary power. Gauge can be furnished to read in gallons per minute, cubic feet per hour, etc., and indicates the rate of flow within 2% of full scale. Gauge mechanism is enclosed in a heavy semi-steel chamber having a thick prestressed glass window designed for an operating pressure of 500 lb per sq in.

LITERATURE AVAILABLE — Bulletin 360.

MADE BY—*Builders Providence, Inc., Div. of Builders Iron Foundry, 82 Codding St., Providence, Rhode Island.* **61**

Protective Coating

NAME—Thur-Ma-Lox.

PURPOSE—High-heat resistant coating for metals.

FEATURES—Coating is claimed to provide a protection against the weather and also high temperatures. In the black finish the pigment changes into a protective surface up to a temperature of about 1600F; for the aluminum finish, 1200F. The black surface, coating No. 7, is said to be effective on weather exposed or sheltered metal surfaces while No. 10, the aluminum finish, is effective on sheltered metal surfaces up to temperatures of 1200F.

MADE BY—*The Dampney Co. of America, Hyde Park, Boston 36, Mass.* **62**

Atomizing Nozzle

NAME—Wall mounted atomizing nozzle.

PURPOSE—For atomization of liquids used in processing work.

FEATURES—Nozzles are made in a variety of materials including brass and stainless steel. Consists of a cap with stainless steel orifice insert, and a body with monel

metal screen or strainer. Cap and core assemblies are renewable. Nozzles are said to provide efficient operation at pressures ranging from 10 to 1000 lb per sq in. Spray is of hollow cone type with uniform distribution of atomized liquid.

MADE BY — *Spraying Systems Co., 4031 W. Lake Street, Chicago 24, Ill.* **63**

June, 1946

TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

On the list below, circle the item number of the equipment in which you are interested, using the number found at the end of each item. This service available only to those giving title and business connection.

24	25	26	27	28	29	30	31	32	33	34	35	36	37
38	39	40	41	42	43	44	45	46	47	48	49	50	51
52	53	54	55	56	57	58	59	60	61	62	63		

Print your name and address, detach and mail to

Editor, HEATING AND VENTILATING, 148 Lafayette St., New York 13, N. Y.

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City.....Zone.....State.....6/46

Abstracts AND Reviews

GUIDANCE FOR THE ENGINEER

Based on an extensive engineering background of which more than thirty years was spent with the Bell Telephone Laboratories, John Mills in his "The Engineer in Society," attempts to show how through misguided counsel in college, many an executive is directed to an unhappy existence as a research worker, and many a student with a research aptitude is directed into other phases of engineering. A great part of the book is devoted to the danger of fitting a round peg into a square hole.

It is largely a recital of experiences and incidents that developed during his many years with the Bell system. He preaches the importance of the engineer and research worker as men of good will.

To the engineer he points out the need for self expression through speaking and writing.

The book makes interesting reading to a college trained engineer because of his many references to college practices and incidents. However, it fails in following through the exciting title selected.

The Engineer in Society, by John Mills. Cloth bound. 5½ x 8 in., 196 pages. Published by D. Van Nostrand Co. Price, $2.50.

INDUSTRIAL AND PROCESS CONTROL

This book was prepared in the Curriculum Laboratory at Cornell University in cooperation with the Taylor Instrument Co. The pneumatic actuating elements and mechanisms of all the other major instrument companies are presented in detail. This treatise is a practical reference on pneumatically controlled instruments and explanations are given without the use of mathematics. Basic control theories are fully explained with relation to recorded chart fluctuations and changes.

Many examples of actual applications of instruments in many kinds of industrial processes are included. Diaphragm control valves and valve positioner mechanisms are also described.

Industrial and Process Control. Spiral bound 8 x 10 in., 233 pages, 170 illustrations. Published by Delmar Publishers, 49 Sherman Ave., Albany 6, N. Y. Price, $2.75.

MODERN MARINE PIPEFITTING

In a very practical book, Emil M. Hansen, Chief Piping Estimator, New York Shipbuilding Corp., attemps to show those interested in marine pipefitting, the various phases of the art. He estimates that the average naval vessel has as much as 50 miles of piping on board. The book places considerable emphasis on the special conditions of marine construction as background material.

The text starts with systems of drawings, symbols for showing piping, valves and fittings, and then goes into a glossary of abbreviations and shipbuilding terms found on drawings.

Various types of piping are covered—heating, air testing, refrigeration, sanitary, cold water, fire system, drains and garbage disposal. It includes interesting material on templates, template bending and pipe bending. At the end of the book, there is a glossary of pipefitting terms.

Here is a practical book written in a style easy to follow. It contains simple illustrations and 4 folded drawings.

Modern Marine Piping, by Emil M. Hansen. Cloth bound, 4¾ x 7 in., 434 pages. Published by Cornell Maritime Press. Price, $3.

OUR OIL RESOURCES

A broad technical and economic picture of petroleum resources has been painted by the author through the medium of 17 articles by 18 outstanding authorities. During World War II this country supplied 90% of the petroleum requirements of the United Nations. Not only has the American petroleum industry developed oil reserves in this country, but also in foreign lands.

The book contains articles by such outstanding men in the field as Eugene Holman, president, Standard Oil Company of New Jersey; John M. Lovejoy, president, Seaboard Oil Company of Delaware; Robert E. Wilson, chairman of the board, Standard Oil Co. of Indiana, and K. C. Heald, chief geologist, Gulf Oil Corp.

The editor has arranged material on oil conservation, technology, oil in public domain, oil and natural gas reserves, capital in the industry.

Currently, oil figures prominently in international politics and this book is, therefore, particularly timely.

Our Oil Resources, edited by Leonard M. Fanning. Cloth Bound, 5 x 8 in., 331 pages. Published by McGraw-Hill Book Co. Price, $4.

● ● ●

MODERN STORES—Basic ideas for store modernization, even under restricted building construction are described in a 170-page paper bound manual, primarily intended for furniture stores but applicable to other retail establishments. Second edition of the manual is the result of a survey of 3,000 large and small stores which revealed that furniture retailers plan a $200,000,000 modernization program for 1946-47. Copies, $2.50 each, may be obtained from the National Retail Furniture Association, 666 Lake Shore Drive, Chicago, Ill.

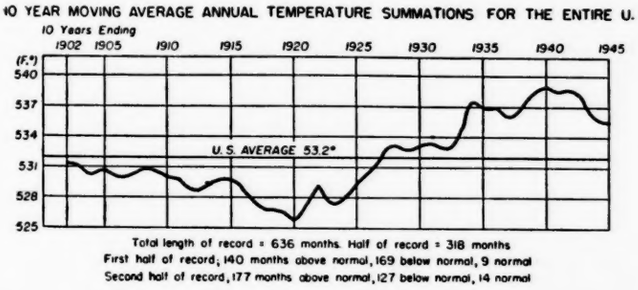
NEWS OF THE MONTH

WEATHER CYCLE

Long term records show past winters more severe and may be so again.

The climate throughout the world has been getting steadily warmer for the past half century or more but some evidence suggests that the peak of the warm cycle has now been reached and that a downward trend has set in, according to the Weather Bureau, Department of Commerce. This does not mean that it will freeze this summer or that next winter's snow storms will be appreciably worse than last. It could happen that this summer would be the hottest ever and next winter unusually mild. But if the cycle continues downward for the next half century as it has continued upward in the past, it may mean a return of the cold winters that existed when Grandpa was a boy.

• **WARMER.**—Although there are many year-to-year variations, special five, ten and twenty-year "moving summation charts" recently prepared show unmistakably that, until the last few years at least, the temperature throughout the world has become steadily warmer.


10 YEAR MOVING AVERAGE ANNUAL TEMPERATURE SUMMATIONS FOR THE ENTIRE U. S.
10 Years Ending
1902 1905 1910 1915 1920 1925 1930 1935 1940 1945
(F.°)
540
537
534
531
528
525
U. S. AVERAGE 53.2°
Total length of record = 636 months. Half of record = 318 months.
First half of record; 140 months above normal, 169 below normal, 9 normal
Second half of record, 177 months above normal, 127 below normal, 14 normal

In moving average charts, the temperature plotted for each year is the sum of the average temperatures of each year in the decade preceding. This is done to smooth out the curve and show long-range trends.

The existence of a world-wide trend towards warmer weather was first established by the Weather Bureau in 1933. In that year J. B. Kincer, then Chief of the Division of Climate and Crop Weather, published a study showing that there was a remarkable correlation between long-term climatic variations for diverse places throughout the world.

• **COLDER.**—There is no way of telling right now what the world-wide temperature trend is because adequate statistics are not available, according to Mr. Kincer. But in the United States, at any rate, there has been a downward dip of the temperature curve for the past few years and it may be that this trend is also world-wide.

Whether this downward trend is merely a short-term variation or is in fact a reversal of the upward cycle cannot be established until more evidence is in, perhaps not for another five or ten years. But it is certain that the theory, once widely held, that the climate for any part of the world is constant and that temperature variations ultimately cancel themselves out, needs to be revised. Long-term changes in climate do exist and the problem is to find out more about them.

Considering only the United States, where adequate records covering recent years are available, analysis of thousands of records shows that the warm temperature upswing extended through 1940. This upward trend is common to all seasons. However, the rise has been most uniform and most pronounced for the fall, winter and spring months.

• **HOW MUCH.**—Comparison of the lowest with the highest mean daily temperature for 10 years shows that at the top of the cycle temperatures averaged over a 10-year period were 2.7F higher in the Eastern United States and 3.7F higher in the Western United States than they were at the bottom of the cycle.

A temperature change of only 3 or 4 degrees does not sound like very much, but it must be remembered that these are 10-year averages. In other words, in the Eastern part of the country each day during the 10-year period at the top of the cycle was on the average 2.7 degrees warmer than the average for any day during the 10-year period at the bottom of the cycle.

Figured on the basis of a 30-day month temperatures during the warm phase were 81 degrees higher in the Eastern part of the country and 110 degrees higher in the Western part than they were during the cold phase.

• **MEANING.**—Climatic phase changes, especially long-sustained warm trends in climate, have a marked economic significance, according to Mr. Kincer. During warm phases such as we have experienced for a good many years, much less fuel is required for heating purposes and, in general, the agricultural seasons are longer.

Also a 3½ degree difference between the average daily temperature of a cold decade, such as experienced 40 to 50 years ago, and that of a recent 10-year period means a decided northward shift in temperate climate. This is important to agriculture.

These temperature trends are not a tool for definite or specific long-range forecasting. However, knowledge about them is valuable as an indication of expectancies or probabilities of temperature conditions for future years, beyond the range of standard forecasting. Limitations are imposed, of course, by the lack of advance knowledge as to when a prevailing trend may go into reverse, but the fact has been definitely established that once prevalent these trends are of comparatively long tenure.

Correction

Dr. C. E. Lapple, Engineering Department, E. I. DuPont de Nemours & Co., Inc., has pointed out an error in the Reference Data Sheet 313-314 appearing in

the March, 1946, issue of HEATING AND VENTILATING. The error occurs in the computation of the settling rate of suspended dust. For the first paragraph, second page of the Data Sheet, read as follows:

"Some estimate of the effect of settling on suspended dust is obtained from the following tabulation of dust having a specific gravity of 1.0:

10 micron dust settles at the rate of 36 ft per hr.
1.0 micron dust settles at the rate of 0.36 ft per hr.
0.1 micron dust settles at the rate of 0.0036 ft per hr."

I regret the error, but even more that I am unable to account for its occurrence.

—*J. M. Dalla Valle.*

SUN HEAT

Russians develop 29.4 pounds of steam with sun and mirrors.

A mirror installation which captures the sun's energy has developed boiler steam pressure of 29.4 lb per sq in. during a 30-minute demonstration at an Uzbekistan preserve factory. The heliostat was developed under the guidance of Dr. Frederico Molero, head of the helio laboratory power institute of the academy of sciences of the U. S. S. R.

• **APPLICATIONS.**—A special cable to the "Christian Science Monitor" states that huge mirrors are being built in Soviet factories to harness the sun's energy for industrial needs, following the successful experiments in Tashkent, Uzbekistan.

These mirrors, planned for use in the central Asiatic republics, give a high concentration of solar rays and the heat generated is to be used to produce steam in boilers. The mirror used in the Tashkent experiment was 33 ft in diameter, but some are much larger.

In operation the mirror, parabolic in form, revolves continuously on a single central base, the light framework of which looks like the wings of a great airplane. Ordinary window glass, bent into the desired shape without preheating, is used for the reflector surfaces. When heat is generated, it is conveyed to a specially constructed boiler. Thence the steam can be piped for heating or processing to any part of the factory.

A smaller installation of the same type was first tested in Stalingrad in 1941. Although trials were carried out in winter, when sunshine was limited, superheated steam at a temperature of 470 degrees Centigrade is reported to have been obtained, and metals, including iron, were melted.

HEATING THE HOME

Heating and piping contractors' convention features home construction, radiant heating.

A session on radiant or panel heating, with an extended question and answer period, was an outstanding feature of the 57th annual convention of the Heating, Piping and Air Conditioning Contractors National Association held at the Ritz-Carlton Hotel, Atlantic City, N. J., May 22-25. More than 460 members and guests registered.

• **HOUSING.**—A feature of the opening session on Wednesday afternoon was a talk by George S. Van Schaick, Vice-President, New York Life Insurance Co., on the Cost of Building Today in Relation to Investment and Operation at a Profit. He reported that his company was putting up garden type homes at Princeton University to house 150 families, and that 3,000 garden type apartments will be constructed on 141 acres in the borough of Queens, New York City. Two and three-story buildings will be erected on only 20% of the land, thus providing for spacious lawns, parks and playgrounds.

Emergency legislation in New York and other states permitted insurance companies to enter the low and medium price housing field. Parkchester is an outstanding example of insurance housing. (For articles on Parkchester, see HEATING AND VENTILATING, June and July, 1939, and May, 1946). Insurance companies, he said, are only interested in a 4-4½% return on their investment.

• **SURVEYS ON HEATING.**—J. A. Ljunggren, Chairman, Home Heating Committee, reported his findings after his committee had visited a large number of homes to obtain owners' opinions. He believes that baseboard radiation is the answer to many heating problems. Within an output range of 240 Btu per sq ft per hr, there are no dust streaks on walls. Since this Btu output will have to be exceeded for only about 15% of the heating season, streaking is not serious. When the G.I. homes were fully insulated—attic and walls—coal consumption per season was cut from 9.5 to 5.5 tons.

R. E. Ferry of IBR reported on a survey made of 54,000 homes in 11 states to learn the types of heating systems favored. Some of the findings were given.

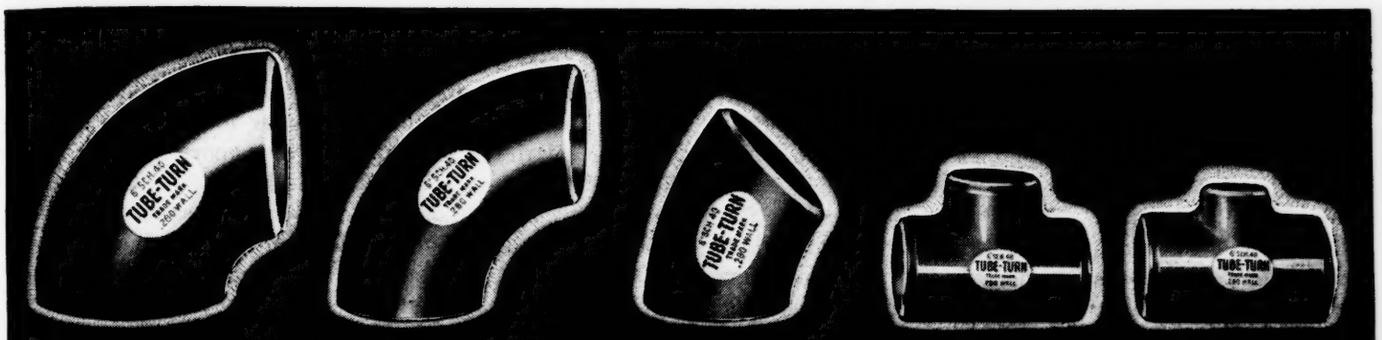
In the metropolitan area of Chicago, warm air heating was favored although architects were predominantly radiant heating minded. Architects said that contractors will have to cut costs before radiant heating use increases. From 1940 to present, there has been a marked trend to the use of gas.

In New England, radiator heating predominates. Hot water heat was favored by 59%.

Metropolitan New York was the only territory that reported a real trend away from steam to warm air. There has been a 31-59% increase in forced warm air. In 1946, 61% used oil. Ohio reported an increase in demand for hotwater systems.

The entire survey indicated that builders and architects prefer hot water or steam heat, although the choice of system is dictated by the user. It is necessary for the contractor to work more closely with the architect and engineer.

• **RADIANT OR PANEL HEATING.**—Four speakers participated in a panel discussion on the why and how of panel heating, at which George P. Nachman pre-



TUBE-TURN

TRADE MARK

WELDING FITTINGS AND FLANGES

TUBE-TURN WELDING FITTINGS—RANGE OF SIZES

Type of Fitting	Description	Standard Weight	Extra Strong	Schedule 160	Double Extra Strong	Light Gauge	
						Nominal Pipe Size	Iron Pipe Size
Elbows	90° Long Radius	½"-24"	½"-24"	1"-12"	¾"-8"	4"-24"	3"-12"
Elbows	90° Short Radius	1"-30"	1½"-30"				
Elbows	45° Long Radius	½"-30"*	½"-30"*	1"-12"	¾"-8"	4"-24"	3"-12"
Returns	180° Long Radius	½"-24"	½"-24"	1"-12"	3"-8"	4"-24"	3"-12"
Returns	180° Short Radius	1"-30"	1½"-30"				
Returns	180° Extra Long Radius	1"-2½"	1"-2½"				
Tees	Straight	½"-24"	½"-24"	½"-12"	½"-8"		
Tees	Reducing Outlet	½"-24"	½"-24"	½"-12"	½"-8"		
Reducers	Concentric & Eccentric	1x⅜-24x20	1x⅜-24x20		1x⅜-8"x6"		
Caps		1"-24"	1"-24"		1"-8"		
Stub Ends	Lap Joint	1"-24"	1"-24"				
Nipples	Shaped. 90° to Header	1¼"-12"	1¼"-12"				
Nipples	Shaped. 45° to Header	1¼"-12"	1¼"-12"				
Saddles		2"-24"**					
Laterals	Straight	1¼"-24"	1¼"-24"				
Laterals	Reducing-on-Run	1¼"-24"	1¼"-24"				
Crosses	Straight	¾"-24"	¾"-24"				
Rings	Welding	¾"-12"	¾"-12"				
Sleeves	Welding	2"-24"**					

SUPER Tube-Turn 45° long radius elbows, 90° long radius elbows, and 180° long radius returns available in both Standard weight and Extra Strong in sizes from 3" to 12".

Tube-Turn welding fittings and flanges conform to applicable ASA and ASTM Standards. For further details please refer to Tube Turns catalog and data book No. 111.

*30" size short radius

**Since saddles and sleeves are used for external reinforcement only, they do not conform to iron pipe size thicknesses.

TUBE-TURN FORGED STEEL FLANGES—RANGE OF SIZES

	150 Lb.	300 Lb.	400 Lb.	600 Lb.	900 Lb.	1500 Lb.	2500 Lb.
Welding Neck	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Slip-on	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Lap Joint	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Threaded	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Blind	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Socket Type	¼"-24"	¼"- 4"		¼"-3½"			
Reducing-threaded or slip-on	¾"-24"	¾"-24"	¾"-24"†	¾"-24"	¾"-24"*	¾"-24"	¾"-12"
Orifice—threaded		1"-24"	4"-12"	4"-12"	3"-12"	1"-12"	
Orifice—slip-on		1"-24"					
Orifice—welding neck		1"-24"	4"-12"	1"-12"	3"-12"	1"-12"	
Long Welding Neck	1"-24"	1"-24"	1"-24"	1"-24"	1"-24"	1"-24"	1"-12"

†Dimensions on sizes thru 3½" same as for 600 lb. flanges.
*Dimensions on sizes thru 2½" same as for 1500 lb. flanges.

sided. The speakers included R. G. Vanderweil, Chase Brass & Copper Co.; C. A. Hawk, A. M. Byers Co.; P. B. Gordon, Wolff & Munier; J. I. Bradfield, Taco Heaters, Inc.

Mr. Bradfield described a system using headers for the supply and return, and 20 ft loops of ¼ ID copper tubing for a gravity open type hot water system. Headers with 6 and 9 in. spaces between connections are available. These two types, together with a selection of loop spacings, make possible systems with any of a variety of heat emissions per square foot of area.

The prolonged question and answer period that followed brought out the following points:

In designing a panel, the hottest part of the panel should be placed next to the coldest surface.

Field joints should be tested to hydrostatic pressures of 200-250 lb per sq in.

Under dry conditions, it is impossible to have electrolytic action of wire screen against copper pipe.

Adding anti-freeze to the water in the panel system, increases the pressure drop by 40-50%.

Tests revealed that when gypsum plaster is placed around copper tubes, there develops a calcinated ring 0.002 in. deep around the tube. Calcination does not reach the rest of the plaster.

• **ENTERTAINMENT.**—A buffet supper and floor show were provided as a get-together party for the first evening. The annual dinner-dance was held the following night.

OIL BURNER

Fuel oil research modifies design of pot type oil burner.

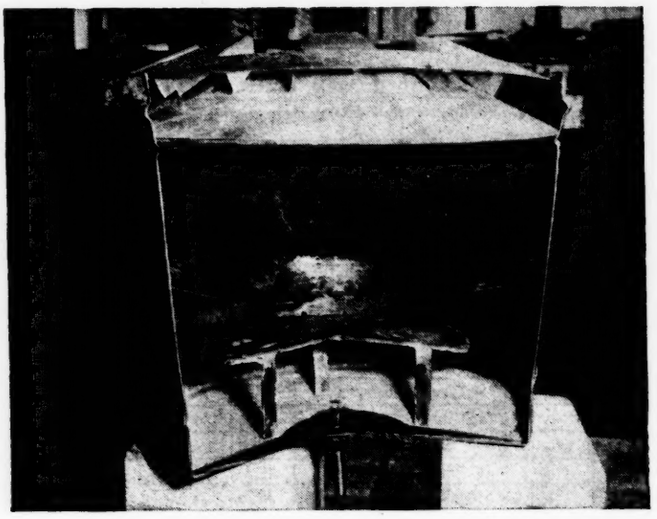
To enable pot type burners to burn No. 2 catalytic cracked fuel oil, a modified pot type burner design was announced by Socony-Vacuum Oil Co., following six months' research. The company does not intend to market this design, but will turn over its findings and will cooperate with pot type burner manufacturers who want to modify their own designs.

• **PRINCIPLES.**—Studies indicated that it is important to protect fuel oil from cracking while it is being vaporized. Therefore the fuel oil must be kept from contact with the hot metal, fuel must be protected from the intense heat radiated from the flame, and the vaporized fuel must be allowed to premix thoroughly with some primary air under reasonably cool temperature to permit partial oxidation.

• **DESIGN CHANGES.**—To assure that the oil is not in contact with the hot metal, the inlet fuel oil line has been placed at the center instead of the side and an insulated surface has been placed on the bottom of the pot. There is a metallic shield above the inlet line. The holes on the side around the interior of the pot are designed to introduce primary air into the vaporizing fuel oil as it rises. Air ducts on the top of the pot have been extended to bring more secondary air into contact with the oil as it meets the flame. The baffle in the middle of the burner is designed to give better mixing of air and fuel oil vapors.

A burner so equipped can burn No. 2 catalytic cracked fuels which not only are cheaper than the No. 1 straight run distillates now burned, but they contain more Btu per gallon of fuel. Such burners will be able to burn all types of home heating fuel oils.

• **MARKET.**—There are about 2,500,000 pot type burners now in use for heating the small home. Results of this research will not only be of interest to users of the present type pot burner who may want to exchange the present pot for one of modified design, but to the developer of homes for the veterans.



Cut-away view of burner shows feed line through center of insulated bottom and primary air holes on sides.

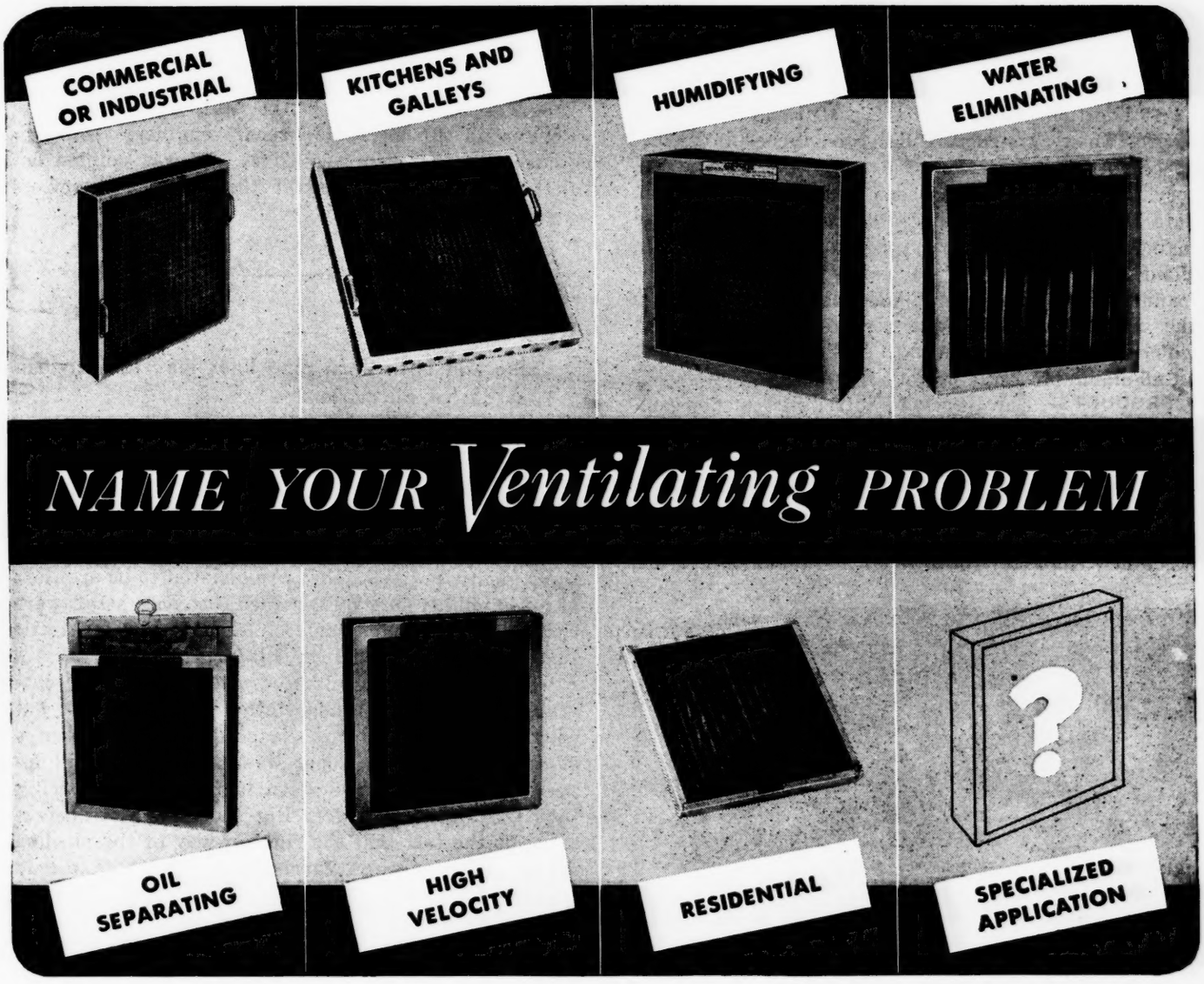
Because of present building costs, and the price limit on homes for veterans, pot type burners become a necessity where fuel oil heat is to be installed. Just when these new pots will be available will depend on how soon burner manufacturers adopt the design. However, it is unlikely that they will be on the market before the 1947 heating season.

TRANE'S MEETING

Sales convention launching company expansion previews wide list of new products.

When the 1946 sales convention of The Trane Co. got under way last month, 165 sales engineers from the U. S., Canada and Mexico were greeted by President Reuben N. Trane and learned of an 83% increase in the company's manufacturing space, an extensive line of new equipment, and plans for the largest advertising campaign in the organization's history.

• **BUILDING PROGRAM.**—Trane's building expansion program, started early last fall, included the complete remodeling of Plant No. 1, the purchase of an ad-



There's an Air-Maze Filter for every application!

Airborne dust, oil, moisture and other impurities are the cause of numerous problems—unhealthy working conditions, materials spoilage, cleaning expense and fire hazards—to name a few.

Whether you are using air to ventilate a kitchen range canopy or to condition a factory, Air-Maze can provide filters exactly engineered for various requirements of efficiency, pressure drop, velocity and price.

Constant research in engineering over 3000 types and sizes of filters in over 20 years, gives Air-Maze rich experience in handling *any* ventilating problem. Write us about *your* particular problem and let us solve it for you.

AIR-MAZE CORPORATION
Cleveland 5, Ohio

Representatives in principal cities

IN CANADA: WILLIAMS & WILSON, LTD., MONTREAL, TORONTO, WINDSOR; FLECK BROS., LTD., VANCOUVER, B. C.

3 Air-Maze Features Give You Over-all Economy, Permanent Efficiency!

1. All metal—permanent, cleanable.
2. Crimped wire media of progressive density—no open areas, low restriction.
3. Large dust-holding capacity—longer periods between servicing.

IF IT USES AIR . . . USE
AIR-MAZE
ENGINEERED AIR FILTRATION
• Oil bath type filters and filter-silencers • Cleanable filter panels for air-borne dirt, oil, grease and liquids • Oil-wetted type filters and filter-silencers
• Exhaust spark arresters • Gear case, crankcase and tank vent breathers
• Oil-separators for engine crankcases • Pull-flow type cleanable oil filters

ditional plant (No. 6) and the construction of a 50,000 sq ft addition to Plant No. 2. At Plant No. 1 the entire two-story structure has been turned into office space with the exception of a newly enlarged laboratory. The laboratory has been extended to accommodate a constant wall temperature room which can be maintained at any temperature from 10 to 125F. In Plant No. 6, steam and hot water specialties will be manufactured. This plant has been converted from the manufacture of Trane aircraft products, all of which have been discontinued with the exception of an all-aluminum radiator for airplanes.

• **PRODUCTS.**—New products introduced at the convention included panel heating systems, baseboard heating systems, convector and cast iron radiation, air conditioning systems, several new steam heating specialties, and new products for chemical, food, and petroleum processing. Introduced for the first time was a new convector-radiator with a universal heating

R. L. Trane, president (exact center), with engineers.

element suitable for all standard steam and hot water heating systems. The new convector-radiator will be made in a single cabinet model which can be installed either as a free standing or semi-recessed unit.

Another new product development shown for the first time was the Trane Custom-Air system of air conditioning. Intended for the large multi-roomed, multi-storied building, this new system combines a number of Trane products in a new system to develop the maximum conditions of comfort.

Other new products included the wall fin heater for industrial use, a dry expansion chiller, several new types of heat transfer surface for process applications, and a number of new steam heating specialty items.

A complete new line of Climate Changers, the company's air conditioning units, was announced in addition to improved evaporative condensers, reciprocating compressors, railway air conditioning units. Numerous other lines have been expanded and improved.

To push these products, as well as Trane's other established lines, the largest advertising campaign in Trane history was briefed by L. A. Trumble, advertising manager, who showed samples of 20 new catalogs printed especially for the convention.

• **TRAINING.**—Renewal of the Trane student training program, interrupted by the war, was announced. Courses in this program prepare engineers for positions as trained representatives. It was pointed out that of the original class of 1925, thirteen members are still on the company's staff.

BIG INCH

Big and Little Inch pipe lines may turn civilian as gas or oil carriers.

Big Inch and Little Big Inch pipe lines are back in the news with a report that two large oil companies are making offers to War Assets Administration for their purchase.

• **ANON.**—While the two companies have not made their identities public, they are believed to be sponsors of a $40 million offer by Big Inch Gas, Inc., a Delaware corporation, for Big Inch. A similar bid for Little Inch was made by Big Inch Oil, Inc.

• **GAS.**—War Assets Administration might have converted Big Inch to transportation of natural gas, but when such a proposal was advanced it resulted in cries of anguish from coal operators, miners and rail interests. Another complication in the proposal of Big Inch Gas, Inc., to convert Big Inch to gas transportation is the fact that the right-of-way of the pipeline through Pennsylvania carries the proviso that only crude and petroleum products may be transported.

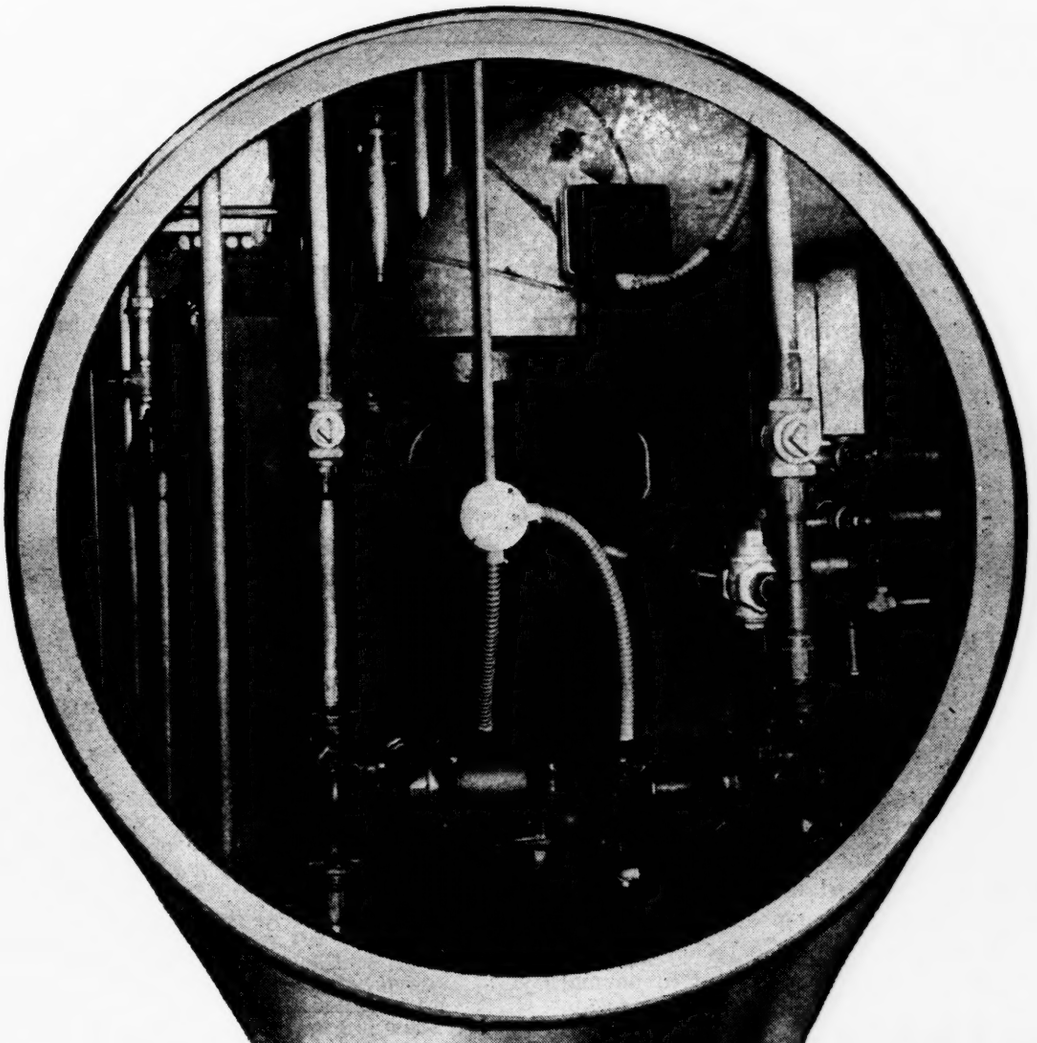
PRESERVATION

Fleet reserve to be sealed and dehydrated for standby.

Admiral Thomas C. Kinkaid, Commander of the Eastern Seafront, has revealed plans for laying up 1,125 ships of the 16th Fleet for future use should the need arise. On the west coast 1,079 units of the 19th Fleet are also being inactivated.

• **MOISTURE.** — Deterioration of ships, according to Naval experts, is due almost entirely to the effects of moisture. Methods for counteracting moisture include dehumidifying the ships' interior with automatic machines. These machines cause a vessel to "breathe," inhaling dry air into compartments and expelling moisture in the air. To protect topside equipment another technique has been developed which will enclose superstructure and gun mounts in a moisture-proof coating which will be applied by spraying. On the hull, protection will be accomplished by applying poisonous hot plastic paint to the outer skin of the vessel. This treatment, said to be effective for five years in salt water and 15 years in fresh water, will kill barnacles or any other life that attempts to cling to the vessel's bottom.

• **COST.** — The cost of sealing a combat vessel has been



A SMOOTH GUN-BARREL FINISH for high water velocities

REVERE Copper Water Tube is cold drawn with precision-finished tools that impart an almost mirror-like surface to the interior of the tube.

This is ideal tube for high velocity circulation in hot water heating systems. Not only are fluid drag and friction minimized when the installation is new, but the interior of rust-proof Revere tube always stays smooth in service.

Because of its corrosion resistance, many engineers and contractors also prefer Revere Copper Water Tube for steam return lines. For the same reasons Revere Copper Water Tube makes superior hot and cold water lines, insuring an unrestricted flow of rust-free water. Joints are made with either soldered or compression fittings which also minimize friction losses.

Made for heating, water supply, air conditioning and other services in all types of buildings, this tube is stamped with the Revere name and the type at regular intervals. Look for these identification marks—they insure full wall thickness and the close gauge tolerances essential for tight sweated joints.

In making your plans you can specify or install such long-lived Revere materials as Copper Water Tube and Red-Brass Pipe; Sheet Copper for tanks, ducts, pans and trays; Sheet Herculoy for tanks; Dryseal Copper Refrigeration Tube (dehydrated and sealed); Copper oil burner, heat control and capillary tubes.

Revere materials are handled by Revere Distributors in all parts of the country. The Revere Technical Advisory Service, Architectural, is always ready to serve you. Call your Revere Distributor.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.

Sales Offices in Principal Cities, Distributors Everywhere.

• • •

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estimated to average about $10,000 and the maintenance program for the 2,204 inactivated vessels will amount to about $4 million a year, exclusive of pay for personnel. An appropriation of $20 million has been set aside for the Bureau of Ships for preservation of the $1 billion inactive fleet. The dehumidifying machines to be used inside the ships will cost $1,500 each. About six machines will be required for a large vessel. Officers in charge of the program (known as "Operation Mothball") expect that a piece of polished brass can maintain a high gloss for 10 or 15 years under ideal conditions of dehydration.

Fourteen ships of the 16th Fleet already have been inactivated, including the cruiser Brooklyn (H&V: 11:45:p96).

COLD TREATING

Mechanical refrigeration used to shrink inserts and improve quality of metal.

Mechanical refrigeration is now being used on passenger auto assembly lines, according to "Business Week." Steel valve inserts are shrunk by refrigeration equipment installed in the motor production line and then are permanently fitted into cylinder blocks.

Chilling to —120F reduces the inserts 0.002 in. in size. An automatic device ejects the treated pieces. At room temperatures, the inserts expand to normal size and become a permanent part of the block. Through this application of mechanical refrigeration, valve inserts are installed at the rate of 360 per hour.

• **SOURCE OF STRENGTH.**—Shrinkage of close fitting parts, however, is only one of the functions performed by mechanical refrigeration in the construction of modern automobiles. Certain steel and other metal parts used in the body of the new cars are stronger and more ductile because of "cold" treatment. High speed drills, hack saws, and other cutting tools used in manufacturing operations have a longer life because ductility and hardness of the cutting edges are increased by cold treating.

Other industries related to the automobile field also use cold treating of metals.

• **OTHER APPLICATIONS.**—For example, an airplane manufacturer doubled production on shrink-fit assemblies of airplane landing struts. Another manufacturer effected a reduction in production costs by utilizing mechanical refrigeration in the shrink-fit assembly of a bushing in the piston of a diesel engine.

In another application, bevel gears are assembled on a spline shaft. A low temperature unit shrinks the spline, permitting fitting of the gear with a hand-operated arbor press. The method saves time and also tends to prevent strains resulting from the former method.

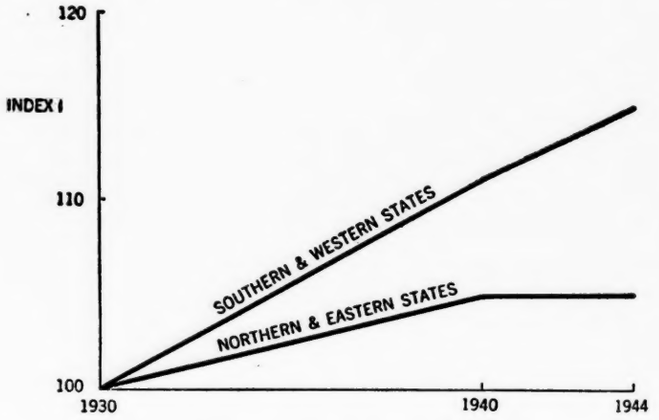
• **A WIDENING FIELD.**—Use of mechanical refrigeration to shrink a cast-iron cylinder liner into an aluminum engine body has also been reported.

Industrial use of cold treating is expected to expand, since the process is versatile and can be used for shrink fitting, freezing to improve machining characteristics, and as a supplement to regular heat treating procedures.

GO WEST

Trend to south and west is found in population and business survey.

Decentralization is apparently the goal of an increasing number of manufacturers, as is evidenced by migration trends brought out in a survey by Ford, Bacon & Davis, Inc. One large company has recently set a policy of no more plants with over 500 employees. A number of F B & D clients are building plants in the west and south on the theory that, since they have to



Population trends index; 1930 = 100.

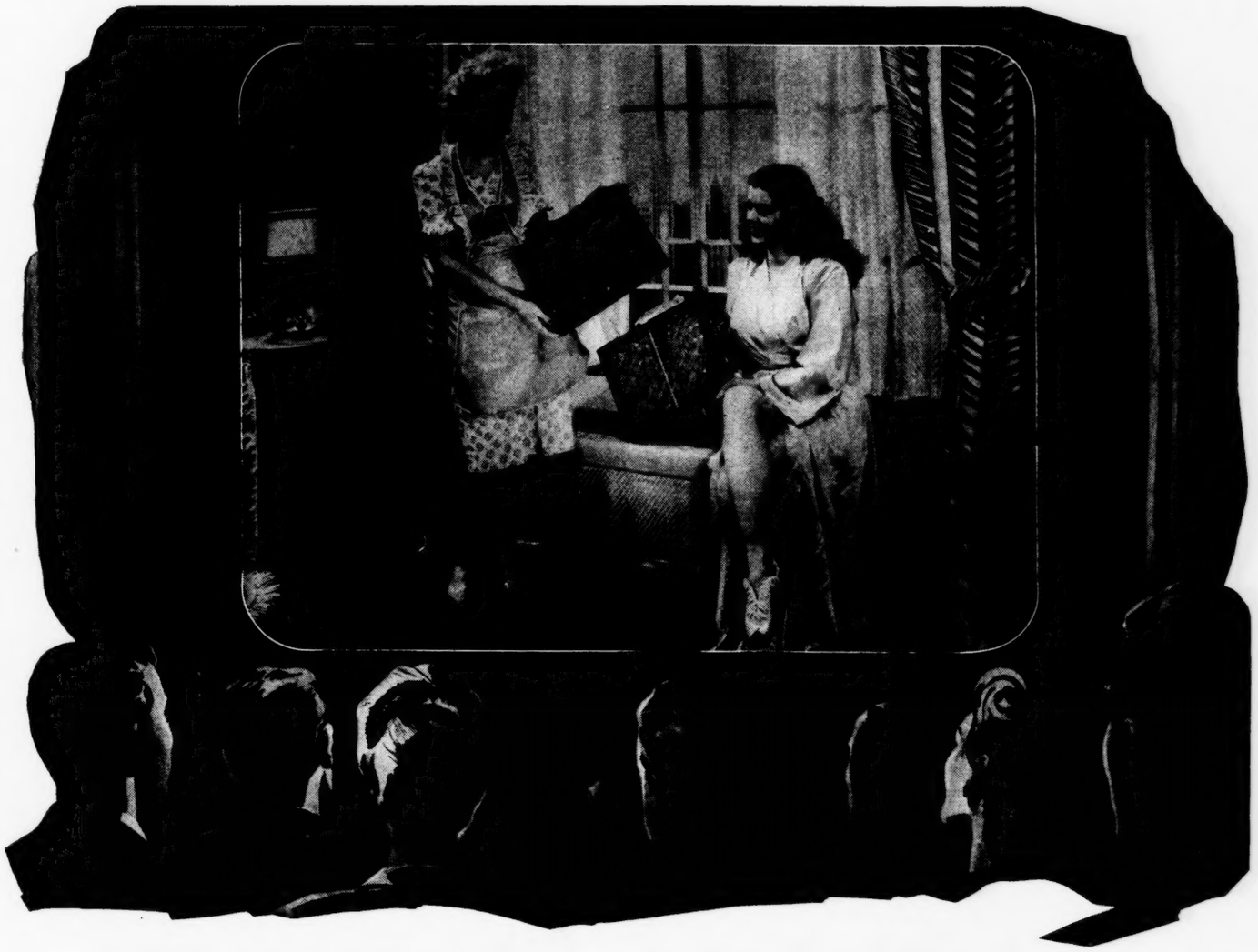
modernize anyway, they might as well follow the growing markets of the less densely populated areas and avoid the congestion, high taxes, high transportation rates, and other disadvantages of the northeastern and eastern areas.

• **MARKETS.** — Markets in western and southern states are growing faster than the United States as a whole, not only in consumer purchases, but industry buying as well. The survey indicates that the southern and western areas with over 40% of the population make scarcely ¼ of the country's manufactured goods. Recently announced are new plants to be built in the south and west to make: Electrical goods, farm machines, household appliances, soft drinks, rail equipment, textiles, tiles, auto parts, paper, glass, chemicals, office machinery, packaging enclosure materials, and also plants to assemble autos and to process foods.

• **POPULATION.** —All but five of the 25 states which increased their population more than the national average in the 10 years 1930 to 1940 are in the south and west.

During the war all but five of the 20 states which increased more than the national average are in the south and west.

• **FACTORS.** — Factors influencing this trend are nearness to markets, raw materials, power, and labor.



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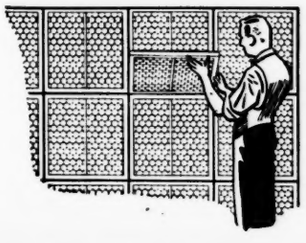
And it's *good business* for you to specify DUST-STOP Air Filter installations. The DUST-STOP is a replaceable-type air filter in which packs of adhesive coated FIBERGLAS fibers provide an efficient medium for catching and holding most atmospheric and manufactured dusts.

DUST-STOP Air Filters, made in a wide range of standard sizes, are adaptable to the smallest residential or largest commercial heating, ventilating or air-conditioning system. They may be installed in custom-built or the complete, ready-to-assemble, DUST-STOP, steel frame cells. These cells can be built up into filter banks *to handle any cfm of air required*. Once the filter bank is installed, maintenance is easy and economical —for replacement, DUST-STOPS are readily available from authorized suppliers in nearly every community.

Complete information on DUST-STOP Air Filters will be sent on request. Write for 24-page illustrated booklet—"Air Filtration in Central Systems" (A5.2.1). Owens-Corning Fiberglas Corporation, Dept. 912, Toledo 1, Ohio. Branches in principal cities.

In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.

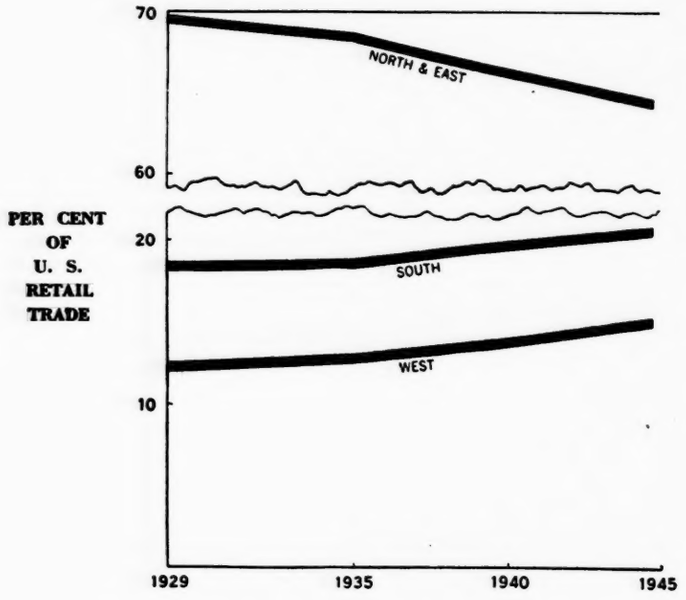


DUSTOP AIR FILTERS

*T. M. Reg. U. S. Pat. Off.

—a FIBERGLAS product

While the past decade has tended to wipe out wage differences favoring one area over another, the southern and western regions are said to hold a high percentage of native born workers. While no claim is made for superiority on this count, some manufacturers are beginning to show a preference in this



Regional shares of consumer goods market.

direction. The survey states that during the war years 1943 and 1944 only 23% of the number of strikes occurred in these areas with over 40% of the population.

Power and fuel are also factors in the southern and western migration. Electrical power is notably cheaper in these regions owing to the construction of projects like Boulder Dam and the TVA. Also, generally speaking, taxes are somewhat lower in these regions. Added advantages of climate and lower plant construction costs are brought out in the survey.

REFRIGERATION CODE

Detroit governed by new rules for refrigeration installation, repair and service.

A new refrigeration code, based on that of the American Standards Association, is now in use in Detroit, Mich. It takes the place of one originally enacted in 1916.

• **LICENSE RULE.**—One of the interesting features of the code is that no person, firm or corporation is permitted to install, repair or service a refrigerating system without first obtaining a city license. Before a contractor can obtain a license, he must pay the necessary fees and post a bond of $1,000 as a guarantee that he will live up to the provisions of the code.

Several types of licenses are issued, either for all types of refrigerating systems or for some special refrigerant with which the applicant is familiar.

• **SMALL HOMES.**—Before work can be done on a refrigerating system it is necessary to obtain a permit. However, permits are not required for the installation or servicing of refrigerating systems in single or two-family houses or for systems containing not more than 6 lb of refrigerant.

The code contains a clause that "ventilating or air circulating systems to be used in conjunction with refrigerating systems shall not be installed, or any alteration made that affects the installation provisions of this ordinance . . . without a permit approved by the department."

• **INSPECTION.**—The city reserves the right to have authorized persons enter a building at reasonable hours to make inspection or tests of refrigerating systems located there.

A copy of the code, 25 cents each, may be obtained by writing to the Department of Buildings and Safety Engineering, Detroit, Mich.

Washington News

(Concluded from page 49)

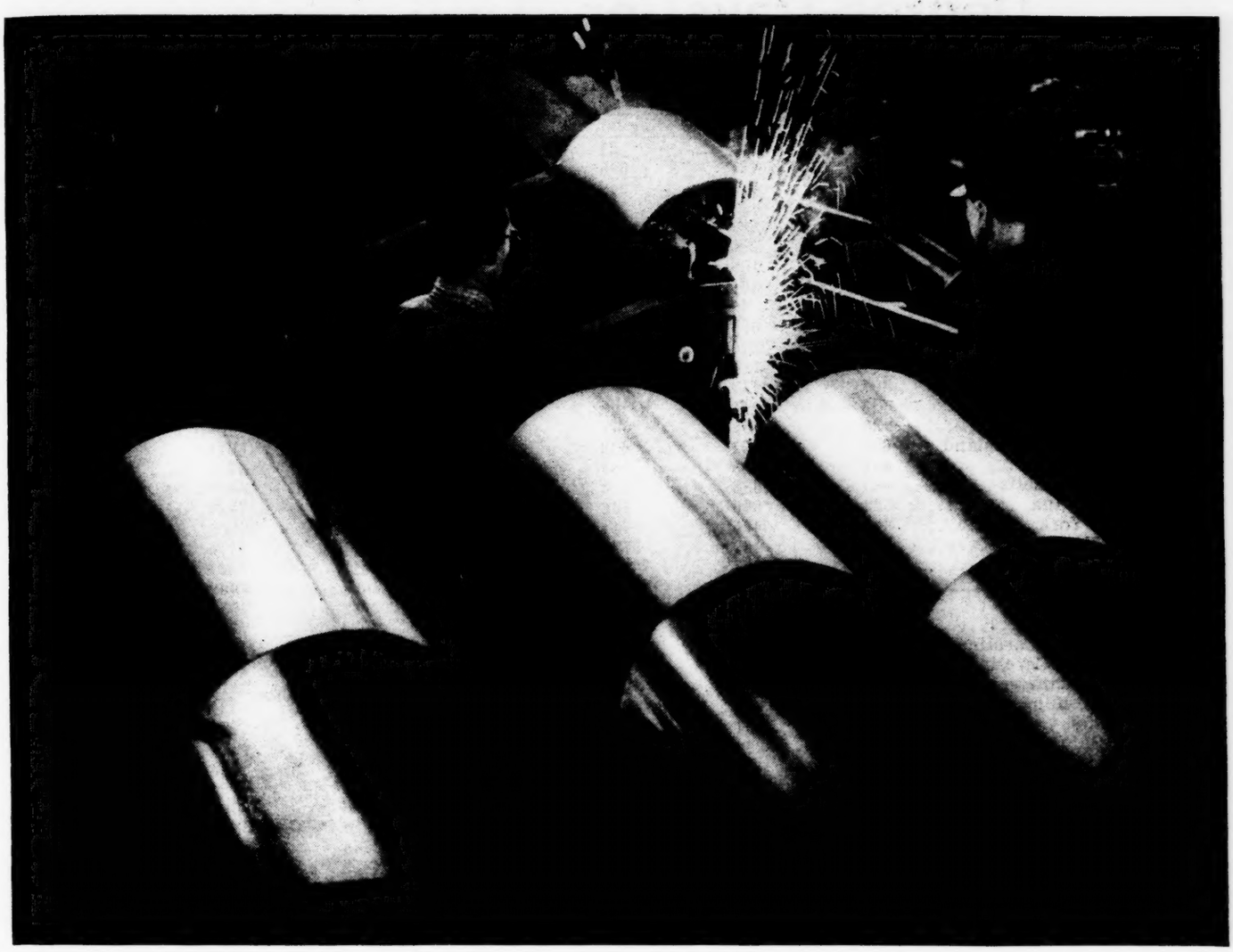
made as to whether to allow a subsidy or to recommend a price increase as the best means of accomplishing the objective of increased production.

Code Change Drive Continues

In addition to its subsidy studies, the National Housing Agency is joining forces with the National Bureau of Standards and the construction branch of the Department of Commerce in urging cities to modernize antiquated building codes and thus remove one of the causes of high construction costs. A long fight is foreseen, however, in reshaping some 2,000 codes to fit modern techniques and new materials. Half of the codes, housing experts found, have been unchanged for 16 years or longer.

Statewide codes, officials said, are providing a promising means of eliminating local variations. Ohio, Indiana and Wisconsin have "fairly complete" codes, while another covering small home construction is being adopted in New Jersey. Other states have regulations covering certain types of construction.

Model codes now in preparation by the Government agencies can be adopted with a few local variations for climatic conditions. Strength of materials has definite standards, it was explained, but codes vary as much as 100 per cent in the working stresses required for steel, concrete, wood and brick of a given quality. Many cities are revising their codes to conform to the veterans' emergency housing program, but others have encountered legal entanglements or opposition from organized groups.



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Degree-Days for April, 1946

HEATING AND VENTILATING'S 19TH YEAR OF PUBLICATION OF MONTHLY DEGREE-DAY DATA

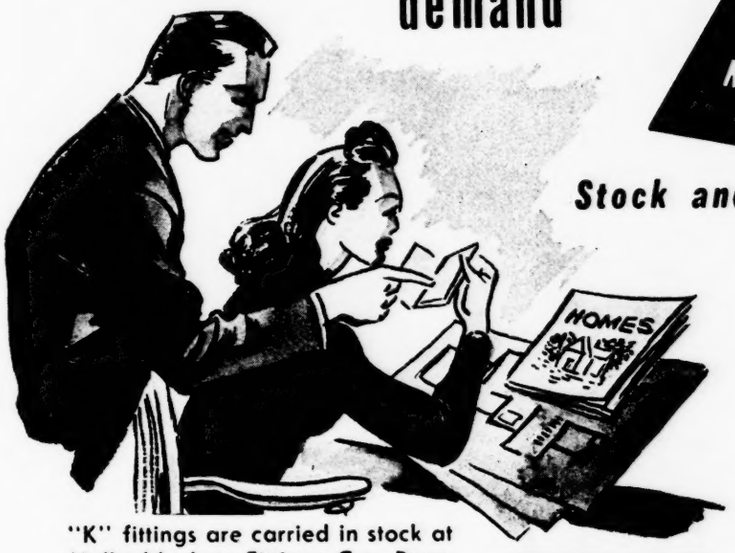
CITY	APRIL			CUMULATIVE, SEPTEMBER 1 TO APRIL 30			HEATING SEASON[1]
	1946	1945	NORMAL	1945-46	1944-45	NORMAL	NORMAL
Abilene, Texas	27	155	27	2361	2447	2061	2061
Albany, New York	608	437	549	6466	6433	6397	6580
Albuquerque, New Mexico	125	379	288	4166	4262	4258	4298
Alpena, Michigan	712	642	789	7126	7097	7662	8299*
Anaconda, Montana	621	884	756	6959	7351	7493	8357**
Asheville, North Carolina	229	226	330	3829	3592	4161	4232
Atlanta, Georgia	102	108	132	2756	2740	2890	2890
Atlantic City, New Jersey	432	364	519	4396	4552	4956	5176
Augusta, Georgia	77	43	24	2100	2063	2161	2161
Baker, Oregon	539	685	615	6362	6216	6519	7163
Baltimore, Maryland	290	216	348	3943	4086	4511	4533
Billings, Montana	367	715	534	5977	6415	6743	7119
Binghamton, New York	607	419	594	6033	6207	6554	6808
Birmingham, Alabama	83	111	69	2635	2558	2352	2352
Bismarck, North Dakota	433	752	657	8275	7934	8809	9192
Block Island, Rhode Island	**606**	**491**	**633**	**5187**	**5236**	**6311**	5788
Boise, Idaho	401	568	435	5396	5378	5316	5552
Boston, Massachusetts	565	388	570	5465	5390	5800	6045
Bozeman, Montana	522	866	731	7071	7211	7724	8521**
Buffalo, New York	620	476	744	6148	6228	6906	6822
Burlington, Vermont	689	469	773	7242	7205	8116	7514
Butte, Montana	643	895	741	7462	7629	7424	8272
Cairo, Illinois	114	141	201	3366	3684	3909	3909
Canton, New York	688	491	684	7507	7462	7686	8020
Charles City, Iowa	386	574	612	6838	6934	7364	7588
Charleston, South Carolina	63	24	36	1737	1773	1769	1769
Charlotte, North Carolina	141	112	159	2850	2929	3120	3120
Chattanooga, Tennessee	119	140	144	3151	3273	3118	3118
Cheyenne, Wyoming	483	908	720	6320	6783	6894	7466
Chicago, Illinois	416	461	518	5525	5441	5764	6077
Cincinnati, Ohio	275	274	333	4247	4736	4684	4684
Cleveland, Ohio	508	400	564	5356	5569	5935	6155
Columbia, Missouri	206	311	303	4320	4716	4900	4922
Columbia, South Carolina	98	57	63	2259	2266	2364	2364
Columbus, Ohio	390	332	420	4851	5110	5311	5398
Concord, New Hampshire	684	481	669	7084	6836	7001	7353
Concordia, Kansas	206	435	342	4535	4833	5250	5315
Dallas, Texas	22	107	9	2085	2200	2256	2256
Davenport, Iowa	314	406	453	5659	5676	6171	6289
Dayton, Ohio	408	365	396	5248	5441	5183	5264
Denver, Colorado	265	683	534	4819	5256	5607	5874
Des Moines, Iowa	282	451	441	5651	5808	6266	6384
Detroit, Michigan	517	448	573	5815	5898	6264	6490
Devils Lake, North Dakota	537	852	756	9417	8591	9450	9970
Dodge City, Kansas	171	459	342	4310	4782	4988	5035
Dubuque, Iowa	339	466	489	6153	6191	6641	6790
Duluth, Minnesota	668	864	801	8555	8243	8746	9443
Eastport, Maine	819	677	786	7183	6832	7398	8520**
Elkins, West Virginia	485	346	501	5279	5418	5520	5697
El Paso, Texas	13	148	45	2533	2545	2428	2428
Ely, Nevada	598	826	—	7044	7264	—	—
Erie, Pennsylvania	549	419	609	5469	5545	6016	6273
Escanaba, Michigan	714	780	828	7522	7618	8118	8771*
Evansville, Indiana	218	249	276	4162	4431	4244	4244
Fort Smith, Arkansas	75	132	93	3012	2994	3147	3147
Fort Wayne, Indiana	481	450	474	5845	6049	5795	5925
Fort Worth, Texas	28	115	27	2127	2225	2148	2148
Fresno, California	100	187	135	2419	2666	2334	2334
Galveston, Texas	1	33	0	1045	974	1016	1016
Grand Junction, Colorado	229	513	384	5298	4914	5430	5548
Grand Rapids, Michigan	487	470	534	5933	5852	6361	6535
Green Bay, Wisconsin	549	589	600	7199	7023	7503	7825
Greensboro, North Carolina	215	169	210	3608	3639	3529	3529
Greenville, South Carolina	149	112	195	3015	2919	3380	3380
Harrisburg, Pennsylvania	404	320	405	4973	5013	5285	5375
Hartford, Connecticut	549	357	531	5906	5822	5834	6036
Hatteras, North Carolina	234	100	255	2398	2614	2571	2571
Havre, Montana	434	764	630	7061	7605	8187	8700
Helena, Montana	506	774	646	6600	7346	7261	7898
Houston, Texas	3	36	0	1188	1152	1157	1157
Huron, South Dakota	386	638	570	7317	7039	7737	8004
Indianapolis, Indiana	333	337	384	4826	4995	5239	5298
*Kansas City, Missouri	183	326	306	4226	4516	4950	4956
Kewanee, Illinois	407	394	472	5533	5516	5996	6139
Knoxville, Tennessee	145	178	210	3318	3455	3670	3670
La Crosse, Wisconsin	441	593	528	7102	6756	7139	7322
Lander, Wyoming	459	948	690	6906	8126	7384	7947

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

Figures in this table, with nine exceptions, based on local weather bureau reports. Exceptions are Utica, Lewiston, Kewanee, Sioux City, and Jackson, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y.; Norman E. Ross, Bursar, Bates College, Lewiston, Me.; J. M. Hartman, Engineering Department, Kewanee Boiler Corp., Kewanee, Ill.; Alfred R. Wagstaff, Engineer, Sioux City Foundry and Boiler Co., Sioux City, Iowa, and H. M. Ludlow, Box 1368, Jackson, Miss., respectively; Anaconda, Bozeman, Butte and Livingston, Mont., through the courtesy of the Montana Power Company.

[Table Concluded on page 104]

"Cash in" on pent-up demand



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1800 KW hours of current per cooling season
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Incidental water consumption and maintenance

} **Per 1000 CFM of heated or cooled air saved**

The above savings are figured for average temperate zones. Some installations have shown greater savings, some less. But in every case, Dorex Air Recovery has *converted contaminated air to fresh air* at a cost much below that required to replace it with an equal volume of outdoor air.

We will be glad to give you the details on actual savings in typical installations or estimate the savings on any existing or planned system. For full information call the nearest District Representative or write Dept. E-11.

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CONNOR

Degree-Days for April, 1946 (Concluded)

HEATING AND VENTILATING'S 19TH YEAR OF PUBLICATION OF MONTHLY DEGREE-DAY DATA

CITY	APRIL			CUMULATIVE, SEPTEMBER 1 TO APRIL 30			HEATING SEASON[1]
	1946	1945	NORMAL	1945-46	1944-45	NORMAL	NORMAL
Lansing, Michigan	545	499	582	6340	6427	6819	7048
Lewiston, Maine	701	526	693	7344	7058	7318	7707
Lincoln, Nebraska	216	448	417	4967	5268	5900	5999
Little Rock, Arkansas	75	104	78	2821	2970	2811	2811
Livingston, Montana	492	789	653	6226	6621	6638	7205
Los Angeles, California	118	178	159	1291	1402	1414	1504
Louisville, Kentucky	222	230	264	3837	4171	4180	4180
Lynchburg, Virginia	257	215	273	3950	4058	3980	3980
Jackson, Miss.	(a)	62	—	(a)	2039	—	—
Macon, Georgia	75	61	33	2169	2112	2201	2201
Madison, Wisconsin	446	541	582	6702	6637	7193	7429
Marquette, Michigan	695	754	804	7483	7324	7968	8693*
Memphis, Tennessee	79	135	96	2944	3118	2950	2950
Meridian, Mississippi	45	66	24	2108	2191	2160	2160
Milwaukee, Wisconsin	540	562	648	6423	6431	6856	7245
Minneapolis, Minnesota	422	634	570	7346	7166	7614	7850
Modena, Utah	452	647	579	5888	6065	6170	6562
Montgomery, Alabama	36	58	0	1925	1803	1884	1884
Nantucket, Massachusetts	(a)	472	639	(a)	5134	5450	5957
Nashville, Tennessee	132	166	180	3342	3548	3507	3507
New Haven, Connecticut	567	389	543	5658	5591	5672	5895
New Orleans, Louisiana	3	30	—	1108	985	1024	1024
New York, New York	457	311	486	4731	4748	5192	5347
†Nome, Alaska	2131	1959	1756	10888	9954	10642	14580**
Norfolk, Virginia	230	149	246	3015	3161	3350	3350
North Head, Washington	532	563	516	4326	3985	4271	5452**
North Platte, Nebraska	263	575	486	5288	5680	6167	6366
Oakland, California	329	285	273	2859	2711	2665	3143**
Oklahoma City, Oklahoma	81	243	162	3075	3346	3613	3613
Omaha, Nebraska	242	454	414	5374	5648	6047	6131
Oswego, New York	657	478	675	6340	6297	6668	7088
Parkersburg, West Virginia	335	268	351	4347	4753	4722	4775
Peoria, Illinois	343	404	453	5562	5673	5988	6109
Philadelphia, Pennsylvania	366	245	402	4340	4413	4787	4855
Phoenix, Arizona	12	89	0	1479	1555	1405	1405
Pittsburgh, Pennsylvania	412	295	423	4697	4911	5157	5235
Pocatello, Idaho	431	675	567	6410	6494	6263	6655
Portland, Maine	735	542	666	7128	6895	6771	7218
Portland, Oregon	368	405	402	4814	3804	4134	4469
Providence, Rhode Island	525	330	558	5255	5150	5764	6015
Pueblo, Colorado	223	605	456	5014	5389	5328	5514
Raleigh, North Carolina	197	117	183	3084	3155	3234	3234
Rapid City, South Dakota	380	732	594	6055	6654	6744	7118
Reading, Pennsylvania	399	292	417	4787	4871	5293	5389
Red Bluff, California	138	171	—	2687	2596	—	—
Reno, Nevada	476	580	534	5320	5514	5436	5892
Richmond, Virginia	232	169	246	3549	3592	3695	3695
Rochester, New York	618	457	618	6296	6417	6472	6732
Roseburg, Oregon	386	429	411	3770	3788	4047	4428
Roswell, New Mexico	59	265	180	3154	3282	3484	3484
Sacramento, California	166	180	207	2552	2579	2600	2653
St. Joseph, Missouri	213	376	342	4603	4859	5145	5161
St. Louis, Missouri	178	253	276	4024	4408	4585	4585
Salt Lake City, Utah	318	603	453	5388	5140	5319	5555
San Antonio, Texas	8	61	0	1508	1543	1202	1202
San Diego, California	91	200	174	1317	1416	1524	1645
Sandusky, Ohio	465	399	726	5339	5551	6025	6208
San Francisco, California	293	275	294	2362	2330	2417	3264**
Sault Ste. Marie, Michigan	817	760	819	8230	8133	8448	9285**
Savannah, Georgia	41	23	0	1581	1465	1490	1490
Scranton, Pennsylvania	528	384	513	5603	5831	5958	6129
Seattle, Washington	421	485	462	3984	3842	4379	4934**
Sheridan, Wyoming	378	774	648	6351	6865	7485	8008
Shreveport, Louisiana	30	51	0	2033	2067	1938	1938
Sioux City, Iowa	339	548	489	6278	6324	6734	6898
Spokane, Washington	512	608	504	5790	5752	5989	6355
Springfield, Illinois	257	321	366	4714	5437	5317	5373
Springfield, Missouri	176	285	267	4067	4406	4416	4428
Syracuse, New York	618	435	630	6320	6357	6614	6893
Tacoma, Washington	459	513	465	4340	4212	4551	5181**
Terre Haute, Indiana	282	309	333	4609	4813	4872	4872
Toledo, Ohio	513	447	525	5811	6091	5897	6077
Topeka, Kansas	187	347	300	4211	4509	4935	4969
Trenton, New Jersey	423	276	402	4748	4808	4852	4933
Utica, New York	625	436	588	7235	6788	6543	6796
Valentine, Nebraska	325	666	561	5966	6603	6766	7039
Walla Walla, Washington	332	421	363	4281	4498	4637	4808
Washington, D. C.	285	197	348	3951	4108	4601	4626
Wichita, Kansas	156	371	252	3977	4312	4673	4673
Williston, North Dakota	439	800	669	8297	7981	8907	9323
Winnemucca, Nevada	413	627	539	5590	5915	5950	6427**
Yakima, Washington	367	439	360	4958	4961	5413	5599

†Nome data are for March.
(a) Data not available.

*Includes August.
**Includes July and August.

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

Reduce Installation Costs

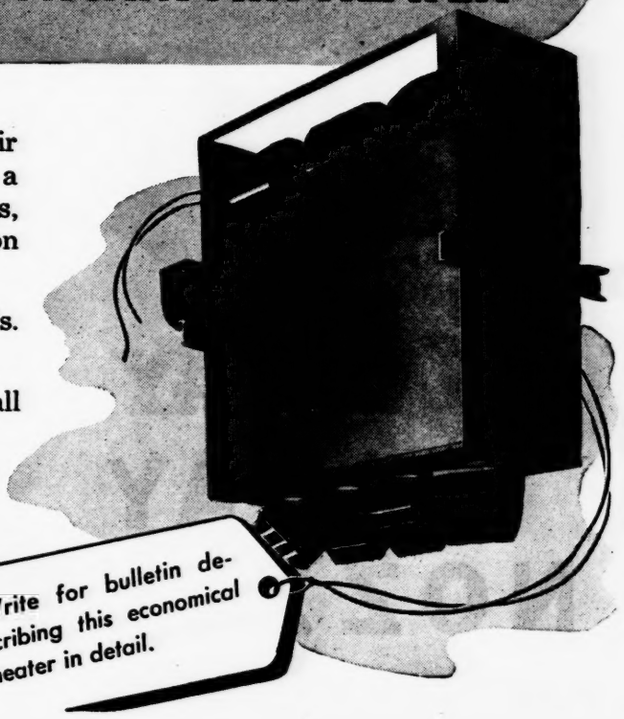
WITH THE LIGHT WEIGHT

AIRTHERM DIRECT-FIRED WARM AIR HEATER

The highly efficient Airtherm Direct-Fired Warm Air Heater is light in weight and may be installed with a minimum of structural expense. Three standard sizes, each in three models: floor mounted, vertical suspension and horizontal suspension.

Nine capacities, from 650,000 to 1,950,000 B.T.U.'s. Either oil or gas fired.

Tests prove efficiencies in excess of 80% on all models.



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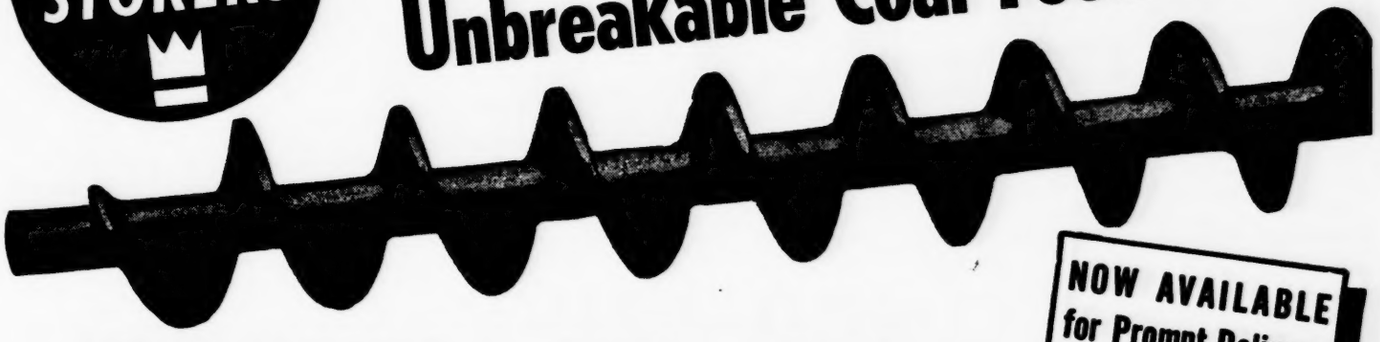
MANUFACTURING COMPANY
722 So. Spring Avenue • St. Louis 10, Mo.

Write for bulletin describing this economical heater in detail.

For **STOKERS**

The CROWN Unbreakable Coal Feed Screw



NOW AVAILABLE for Prompt Delivery

WELDED All-Steel Worm—All Sizes—All Pitches

★Crown's complete line of all-steel Coal Feed Screws meets every replacement and production requirement. Produced for both domestic and industrial stokers. Crown Screws are available with right or left hand screw, in all sizes and pitches, tapered or straight, and in combinations of pitches. Uniformly smooth surfaces insure that coal will flow freely and easily through the flights. Because it is all-steel with continuous weld, the Crown Coal Feed Screw guarantees long, continuous operation with full customer satisfaction. Crown is in a position to make prompt delivery on all sizes.

In ordering give complete specifications on size and design.

CROWN IRON WORKS COMPANY
1207 Tyler St., N. E. *Since 1878* Minneapolis, Minn.

for • SPRAYING
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• RINSING
• COOLING
• AIR CONDITIONING

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SPRAY NOZZLES

FAN-TYPE FOR FLAT SLICING SPRAY

Get the most out of your Spraying Equipment with minimum power . . . with efficient spraying.

Use Yarway Nozzles. No internal vanes or other restrictions to clog or hinder flow. Two types—Yarway Involute-type producing a fine hollow spray with minimum energy loss, and Yarway Fan-type producing a flat fan-shaped spray with time-saving slicing action for cleaning.

Wide range of standard sizes and capacities. Cast or machined from solid bar stock.

Thousands in use. Write for new Bulletin N-616.

YARNALL-WARING COMPANY
104 Mermaid Avenue Philadelphia 18, Pa.

NEW CATALOGS

Refrigerator Fans

"New Life and Efficiency for Refrigerated Areas," an 8-page booklet, No. 241, presents data on flow charts, installation diagrams and pertinent information about proper air circulation for refrigerators.—*Reynolds Electric Co., 2650 W. Congress St., Chicago 12, Ill.* 18

Electronic Potentiometer-Pyrometer

A new electronic potentiometer-pyrometer which has no continuously moving or vibrating parts in its measuring circuit is described in Bulletin No. 232. This 16-page bulletin also illustrates various indicating, recording and controlling combinations, gives performance data, and outlines principle of operation.—*Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10, Ohio.* 19

Versatile Plastic

Titled "Koroseal, The Modern Flexible Material for Industry," an 18-page booklet outlines the material's resistance to destructive elements, including corrosives, oils and solvents, flame, water, moisture, heat and aging, sunlight and oxidation. Mechanical properties, including adhesion to other materials, flexing, machining qualities, abrasion resistance, coefficient of friction, hardness, impact strength, tensile strength, elongation, compressibility, compression set and dielectric strength are discussed. Numerous industrial applications of Koroseal in all its forms are pictured and described, with a chapter devoted to consumer uses of the material.—*B. F. Goodrich Co., Akron, Ohio.* 20

Electronic Flow Control

A new bulletin, No. 42-A, describing a low flow rate measuring instrument is available. Drop-by-drop flow rates down to less than 5 milliliters of liquid per minute, and for gases to less than 25 milliliters per minute, cannot only be measured but remotely and automatically recorded, controlled and totalized with the recently developed Rota-Tronic instrument.—*Fischer & Porter Company, Department 1T-4, Hatboro, Pennsylvania.* 21

Pipe Coating

Electrodeposition of nickel plate on pipe, tubing, and fittings and nickel welding of tubing is described in an 8-page illustrated brochure.—*Bart Mfg. Co., Inc., Belleville 9, N. J.* 22

Protective Coatings

"Organic Protective Coatings and Their Performance on Electrolytic Tinplates" is the subject of a folder published by Watson-Standard Co., Pittsburgh, Pa. Prepared by C. H. Groff and I. R. Messer, the folder outlines variables which affect properties and performance of electrolytic tinplates, and is complete with tables and charts of test results.—*Watson Standard Co., Pittsburgh, Pa.* 23

Air Conditioning—Refrigeration—Unit Heating

A catalog of Carrier air conditioning, refrigerating, and unit heating equipment with products and data concerning them arranged for the convenient use of architects and consulting engineers is the same as the Carrier insert in Sweet's Architectural File for 1946 and bears an A1A Number so that it can be filed for easy reference.—*Carrier Corp., 300 So. Geddes St., Syracuse 1, N. Y.* 24

Condenser Tube Inserts

New bulletin describes Flowrites, metal inserts for inlet ends of condenser tubes, which prevent tube end erosion. Shows reports of tests conducted at Massachusetts Institute of Technology, with tables, graphs, and data showing how condenser operation is improved with Flowrites. Installation instructions are included. —*Condenser Service & Engineering Co., Inc., Hoboken, N. J.* 25

Exhaust Fans

"Planing Mill Exhauster Catalog", No. 430-3, gives uses, construction and sizes of exhaust fans which are particularly designed for dust control, fume exhaust, and collecting and conveying materials which can be carried on a current of air. Outstanding feature is large capacity for a given size and high efficiency. Performance tables give ratings for fans with wheels from 25 in. to 60 in. diameter with capacities from 680 cfm to 20,000 cfm at pressures from 1 in. to 12 in. static pressure. A special table permits a short cut method for determining fan performance, making extensive calculations unnecessary, and a chart is included, showing pressure loss in round ducts.—*B. F. Sturtevant Co., Division of Westinghouse Electric, Hyde Park, Boston 36, Mass.* 26

V-belt Sheaves

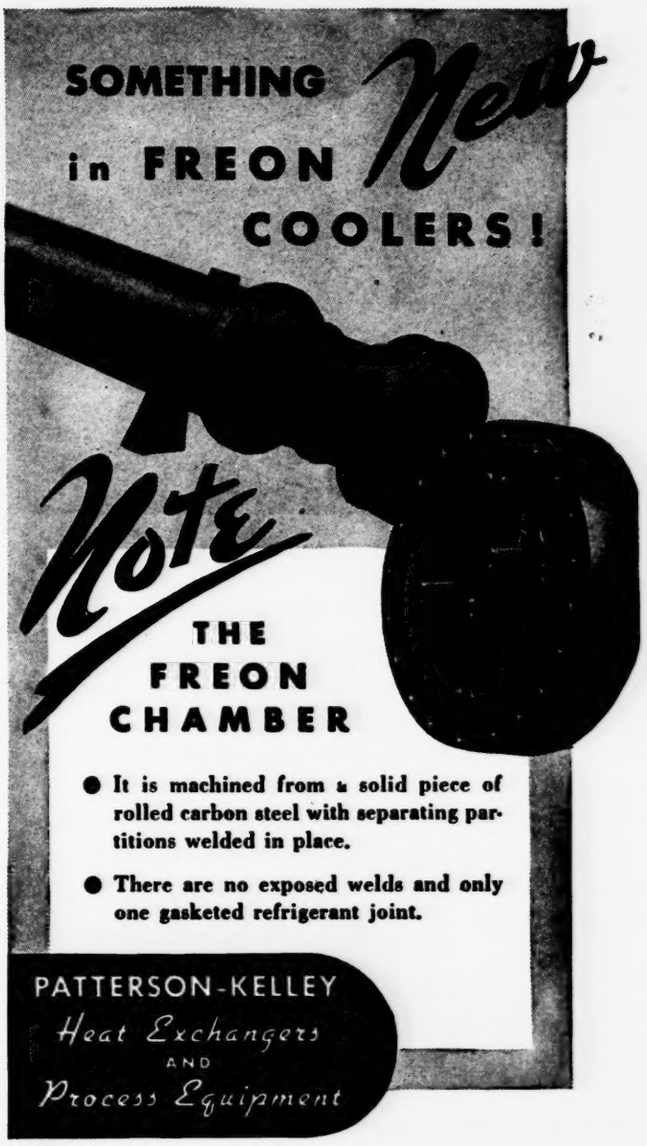
A 40-page loose-leaf style price list and catalog of V-belts and sheaves contains dimensions and specifications for standard and non-standard V-belt drives.—*The Medart Co., 3500 DeKalb St., St. Louis, Mo.* 27

Welding Accessories

A complete line of electrode holders, ground clamps, connectors, terminals, and other welding accessories including a new welding cable splicer is described in the new 1946 "Twecolog."—*Tweco Products Co., Wichita 7, Kan.* 28

Tube End Forming Equipment

A 4-page bulletin describes the Vaill No. 6 tube end forming machine and its applications for such operations as beading, flaring, flanging, expanding, reducing, double lap flaring and flanging the ends of tubing ranging from ⅛ in. to 1 in. in diameter.—*Vaill Engineering Co., 70 N. Elm St., Waterbury 89, Conn.* 29



This Freon Chamber represents a marked advance in the design and construction of coolers. It is an indication how wide awake Patterson-Kelley engineers are to the trends... how well they have anticipated the industry's requirements in Freon Coolers.

Designed primarily as a Dry Expansion Water Cooler, this unit in modified form is applicable to general refrigeration needs using calcium chloride brine, ethylene glycol, alcohol, propylene glycol and other liquids.

If required, it can be constructed of stainless steel, Monel, nickel or other corrosion-resisting metals.

With the many variations of this Cooler and a complete line of Flooded Coolers and Refrigerant Condensers, we are equipped to serve you in a broad way. We shall be glad to help you with both design and application problems as well as to manufacture to your requirements.

EST. (PK) 1880
THE PATTERSON-KELLEY Company, Inc.
122 WARREN STREET, EAST STROUDSBURG, PA.
BOSTON 16, 96-A Huntington Avenue • NEW YORK 17, 101 Park Avenue
PHILADELPHIA 3, 1700 Walnut Street • CHICAGO 4, Railway Exchange Building
Representatives in All Principal Cities

A-P Dependability

GOOD "PERFORMANCE INSURANCE" ON YOUR AIR CONDITIONING INSTALLATIONS

Experience may have shown you, too, that an A-P Thermostatic Expansion Valve on any air conditioning system is practical assurance of "trouble-free" refrigerant control so important to maintaining steady cooling efficiency. That's why A-P DEPENDABILITY, proven on thousands of installations, means so much to engineers responsible for these systems.

But A-P DEPENDABILITY is a proven fact long before you install the Valve on your unit . . . proven in amazing detail in every phase of production and operation. For instance, even before Expansion Valve diaphragms are made, a sample of the material is tested the equivalent of 15 years service in a valve. This is only one of the many "preproofs of A-P DEPENDABILITY" helping you to more efficient and trouble-free air conditioning.

A-P Model 220-K Thermostatic Expansion Valve

Used as DEPENDABLE original—and replacement — equipment on the country's largest and most famous air conditioning and refrigeration installations. Capacity, to 16 tons Freon, 32 tons Methyl.

AUTOMATIC PRODUCTS COMPANY

2462 North Thirty-Second Street, Milwaukee 10, Wisconsin

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DEPENDABLE *Valves* for Air Conditioning — Refrigeration — Heating

Flow Indicators

Full detailed descriptions of Schutte & Koerting flow indicators including sectional drawings of construction features, operation principles, applications and characteristics of the different types are available in a new Bulletin (18-W).—*Schutte & Koerting Co., 12th and Thompson Sts., Philadelphia 22, Pa.* 30

Air Conditioning

Issued by Carrier Corp. as one of a series of 36 new catalogs, a new 40-page booklet explains the working of the familiar sling psychrometer, by separating the wet and dry bulb graphs on a series of a dozen charts simulating several weather conditions and explaining, step by step, how "outdoor" air is converted to proper indoor temperature and moisture. The Carrier publication takes the mystery out of the fundamentals and reveals the simple relationships between proper atmospheric conditions and efficient production. Aside from providing a practical gauge by which textile mill air conditioning can be operated most efficiently, the catalog also describes in detail six systems which can be adapted to the needs of individual textile mills. —*Carrier Corp., Syracuse, N. Y.* 31

Refractory Concrete

A new edition of "Lumnite for Refractory Concrete" has been published. This 24-page booklet contains basic information on materials and methods used in making refractory concrete for different temperature and insulating requirements and reflects the results of service experience and laboratory investigations since publication of the original booklet on this subject in 1938.—*The Atlas Lumnite Cement Co., 135 East 42nd St., New York 17, N. Y.* 32

Water Cooling and Heating

A series of folders, loose-leaf style, describing Downingtown water chillers, condensers, and coolers, refrigerant receivers and water heaters. Each folder carries tables of sizes and dimensions with data on surface, circulation, and other specifications.—*Downingtown Iron Works, Inc., Downingtown, Pa.* 33

Fan Catalog

A new 28-page catalog, Unit X5549, illustrates in color and describes in detail the complete line of Emerson-Electric Fans for the first post-war season.—*The Emerson Electric Mfg. Co., St. Louis, Mo.* 34

Burner Ignition Insulator

Bulletin No. 745, describes the use of AlSiMag 42 for oil burner ignition insulators; its electrical-mechanical properties; and the various standard and special sizes in which ignition insulators are available. AlSiMag 42 insulators are described as well able to withstand heat shock and at the same time to retain their insulating qualities. — *American Lava Corp., Chattanooga 5, Tenn.* 35

Axial Flow Pumps

A 16-page bulletin, No. G-845, covers axial flow pumps for condenser circulation, sewage plant circulation, irrigation and other applications where large volumes of water are required at moderate heads. Capacities are up to 100,000 gpm and heads to 50 ft. Both propeller and mixed flow impellers are available in all ranges and capacities.—*Economy Pumps, Inc., Hamilton, O.* 36

Process Heating

Details of the Blaw-Knox Supertherm System of process heating, which uses superheated water, are described in a booklet showing applications in the manufacture of molded plastics, rubber, textiles, ceramics, floor coverings, wall paper, and chemicals.—*Power Piping Division, Blaw-Knox Co., 15-25 Pennsylvania Ave., Pittsburgh 12, Pa.* 37

Pipe Fittings

No-Thread fittings are the subject of a descriptive brochure, No. 418B, which shows how to join pipe without thread. Applications for fluid and gas transmission are described. — *Dresser Mfg. Division, Dresser Industries, Inc., Bradford, Pa.* 38

Water Level Control

Water level control methods at Parkchester, world's largest housing project located in New York City, are described and illustrated in editorial style in Bulletin 451.—*Northern Equipment Co., Erie, Pa.* 39

Catalogs Wanted

The Veterans Administration Construction Service, Branch Office No. 4, 900 N. Lombardy St., Richmond, Va., desires to receive catalogs of materials and equipment from manufacturers and jobbers covering general building construction, electrical, heating, ventilating, plumbing, refrigeration, air-conditioning and outside utilities.

JUNE, 1946

TO OBTAIN COPIES OF TRADE LITERATURE listed in this issue, circle on the list below the publications wanted, using the item number at the end of each review. This service available only to those giving title and business connection.

Print your name and address, mail to
Editor, HEATING AND VENTILATING,
148 Lafayette Street, New York 13, N. Y.

18	19	20	21	22	23	24	25	26
27	28	29	30	31	32	33	34	35
36	37	38	39					

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2 YEARS OF EXPERIENCE

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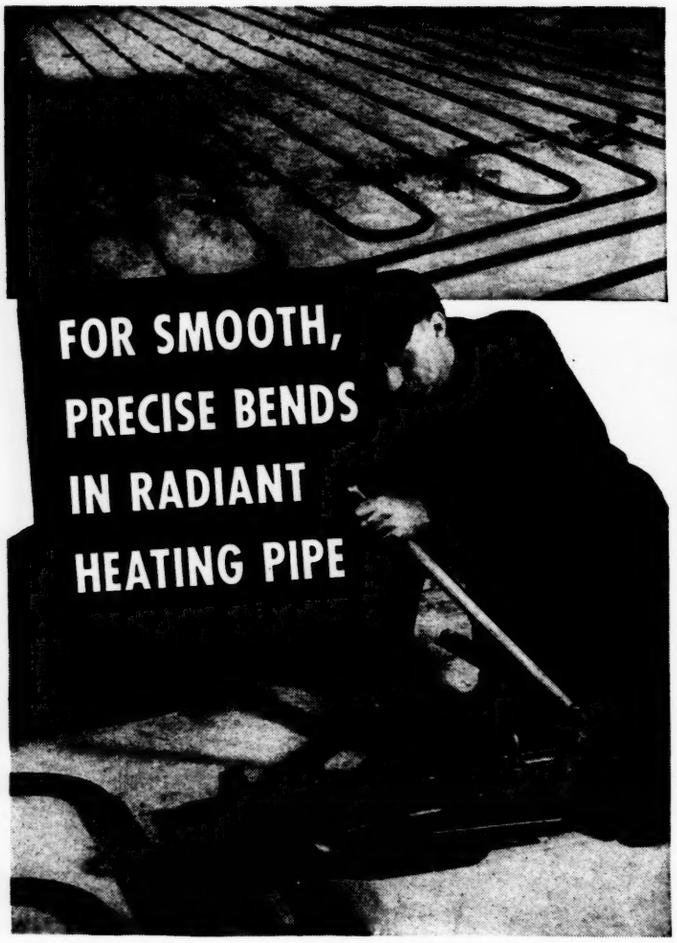


● Install radiant heating pipe the swift, sure way...with the GREENLEE 770-R Hydraulic Pipe Bender which makes precise 90° and return bends in *cold* pipe of sizes ½" through 2".

After making the above illustrated radiant installation with the aid of a GREENLEE, Bilz Plumbing and Heating Co., Spring Lake, Michigan, reported as follows. "One man operates the GREENLEE Bender easily *and fast*, thus providing a tremendous saving in labor hours."

"There's no flattening of pipe with a GREENLEE Bender, it brings substantial savings in fittings and manufactured bends. And, most important, there is *much less friction loss* in the system with curve bends instead of regular square fittings."

Do the job easier, faster, *better* with a GREENLEE. One-man-operated, compact, portable for on-the-job work. Two models for pipe from ½" to 4½". Write for details. Greenlee Tool Co., Division of Greenlee Bros. & Co., 2326 Twelfth Street, Rockford, Illinois.

REGISTERED TOOLS
GREENLEE
FOR THE CRAFTSMAN

Getting Personal

G. H. Hall

George H. Hall (*Motors and Drives for Fans and Blowers*, page 58) is a true "down Easter." A native of Bangor, Me., he holds an M.E. degree from the University of Maine.

Following graduation, he spent a few years in Providence, R. I., with the Builders Iron Foundry, and the American Ship Windlass Co. He came to New York as Associate Editor of *Machinery*. Then came an extended period with the General Electric Co. in application engineering and sales work. For a time Mr. Hall was in charge of sales and application of ozonators. On the basis of his long G. E. service, he was retired in 1933.

Since that time he has engaged in writing technical articles and juvenile fiction. He is the author of a textbook, "Motor and Control Applications," published by McGraw-Hill.

Mr. Hall was a Captain in the Army Ordnance Department during World War I, and was stationed at the Watertown, Mass., arsenal.

INDUSTRIAL DEGREE-DAYS

April, 1946

City	55F Base	45F Base
Baltimore, Md.	71	0
Buffalo, N. Y.	328	103
Chicago, Ill.	180	44
Cleveland, Ohio	235	55
Detroit, Mich.	241	53
Indianapolis, Ind.	120	15
New York, N. Y.	180	18
Philadelphia, Pa.	122	5
Pittsburgh, Pa.	151	14
St. Louis, Mo.	33	1

Canadian Degree-Days for March and April, 1946*

City	March 1946	March Normal	April 1946	April Normal	Cumulative, Sept. 1 to Apr. 30 1945-46	Cumulative Normal
Calgary, Alta.	949	1215	612	750	8287	8631
Charlottetown, P. E. I.	1020	1203	849	858	7478	7727
Crescent Valley, B. C.	831	961	582	624	6746	7328
Edmonton, Alta.	1076	1290	624	780	9243	9353
Fort William, Ont.	1079	1386	837	888	9465	9478
Grand Prairie, Alta.	1228	1339	780	822	10260	9617
Halifax, N. S.	861	1073	786	768	6685	6909
London, Ont.	732	1073	654	642	6833	6968
Medicine Hat, Alta.	775	1150	468	606	7920	8194
Moncton, N. B.	998	1190	909	798	7985	8094
Montreal, P. Q.	848	1209	715	702	7952	7986
North Bay, Ont.	967	1280	816	813	9026	8746
Ottawa, Ont.	834	1256	696	726	8069	8364
Penticton, B. C.	753	787	441	507	5848	6073
Porquis Junction, Ont.	1091	1550	987	972	10305	10586
Prince George, B. C.	992	1091	783	738	8316	8506
Quebec City, P. Q.	980	1311	825	849	8355	8848
Regina, Sask.	1194	1504	600	816	10033	10457
St. John, N. B.	899	1132	834	792	7372	7576
Saskatoon, Sask.	1138	1445	600	725	10130	10081
Toronto, Ont.	698	1072	621	675	6408	6901
Vancouver, B. C.	673	682	525	498	4943	4977
Victoria, B. C.	636	651	504	504	4536	4569
Windsor, Ont.	617	995	528	582	6007	6454
Winnipeg, Man.	1091	1531	627	822	9940	10444

*These data are supplied through the courtesy of the Meteorological Division, Air Service Branch, Department of Transport, Canada, with the cooperation of N. W. Etter, Heating Engineer, Enamel & Heating Products Limited, Sackville, N. B.

. . . Since the Last Issue

It was announced by O. D. Colvin, president of **Cargocaire Engineering Corp.**, that **Colvin-Slocum Boats, Inc.**, and **The Landley Co.** had merged with Cargocaire.

Samuel H. Shipley, president of **York-Shipley, Inc.**, York, Pa., manufacturers of York-Heat domestic, commercial and industrial oil-fired equipment, was elected vice-president of Oil Heat Institute of America at the 23rd Annual Convention held recently at Philadelphia, Pa. Mr. Shipley is a graduate of Lehigh University, in Engineering, and has had 28 years of experience in the field of automatically controlled temperature equipment.

The appointment of **Donald L. Davison** as the new Deepfreeze eastern regional sales manager has been announced by **Deepfreeze Division, Motor Products Corp.**, North Chicago, Ill. Mr. Davison will make his headquarters in New York with responsibilities embracing the Boston, New York and Philadelphia districts.

Arrangements have been completed whereby the **Blaw-Knox Co.** of Pittsburgh takes over from the **J. O. Ross Engineering Corp.** of New York all engineering, sales, fabricating and installation of the Ross Supertherm hot water heating system in North and South America. The Supertherm system which utilizes super heated water for industrial heating was originally promoted in Europe by a company associated with the Ross organization.

The Universal Valve and Fittings Co., Cleveland, announces the appointment of **A. Bundy Jones** as sales representative to cover the territory east of Cleveland. He replaces **Ernest B. Saghy**, who has been brought to Cleveland to serve the downtown metropolitan and westside Cleveland area. Another Universal Valve promotion is the appointment of **Arthur J. Drescher**, for the past six years in charge of the company's contract order department. Mr. Drescher is now transferred to the sales department to head up sales to contractors.

There are two recent developments in the **Cole-Sullivan Engineering Co.**, Minneapolis, Minn. The name of the corporation, one of the pioneer concerns in the barometric control industry, has been changed to the **Cole-Sewell Engineering Co.**, and they have purchased a larger building in the industrial district between the Twin Cities.

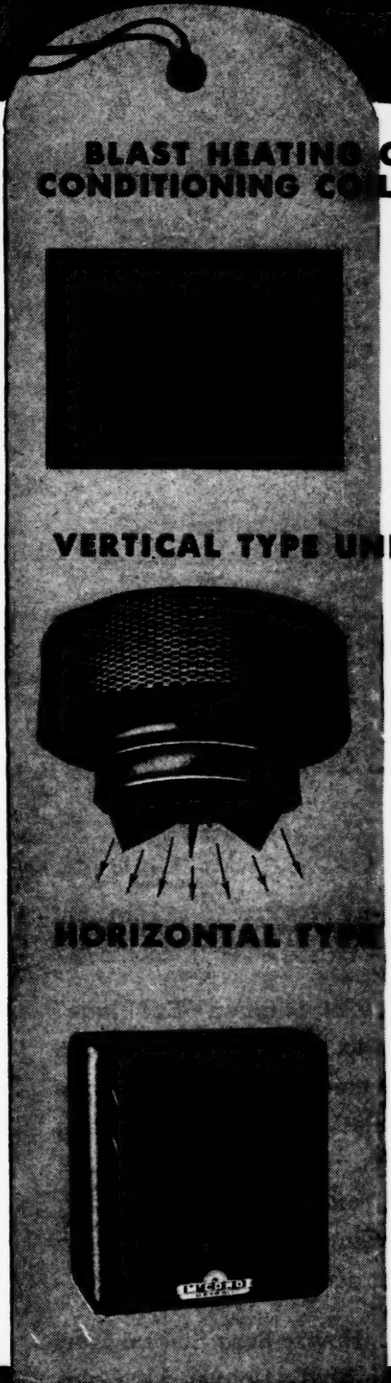
A new company, the **No-No Specialty Co.** of 6915 Quincy Ave., Cleveland, Ohio, has been formed to handle the national distribution for Micromet and Micromet Feeders, for water treatment.

Dr. John F. Gall has been appointed assistant research supervisor, **Whitemarsh Research Laboratories, Pennsylvania Salt Mfg. Co.**, to assist in the coordination of the experimental activities of the Research Division.

President Oscar Werwath announces the appointment of **Robert Collard** to the faculty of the **Milwaukee School of Engineering** as an instructor in mechanical design and drafting for courses in heating, ventilating, and air conditioning. Prior to service in the Navy, Mr. Collard worked as a drafting designer for the Pines Engineering Co., and for the American Well Works, both of Aurora, Ill.

The **Coolstream Corp.**, manufacturer of electric water coolers, has moved into its new plant, 240 Butler Street, Brooklyn, N. Y., where it is expanding production facilities.

McCORD
HEATING AND AIR CONDITIONING PRODUCTS



BLAST HEATING COILS—AIR CONDITIONING COILS—ALL TYPES

All copper spiral fin tube construction with the tubes formed or bent permits uniform expansion without strain. Headers are heavy wall construction with tubes brazed into extended ferrules formed in the headers. Fins are helically wound and metallically bonded. May we send catalog?

VERTICAL TYPE UNIT HEATERS

A proven heating unit, modern in design, incorporating every unit heater advancement. McCord copper spiral fin tube construction creates air turbulence without undue restriction. Improved fan blades deliver large volume of air with minimum air noise. Guaranteed for 150 lbs. saturated steam pressure. Specify McCord.

HORIZONTAL TYPE UNIT HEATERS

A time proven heating unit, modern streamlined in design, quiet, yet its rugged construction adapts it to all types of installations, guaranteed for use on No. 150 p. s. i. steam pressure. All copper heating element, individual spiral fin tubes free to expand without strain on joints. Standard motors with standard bases used. Wide range of capacities.

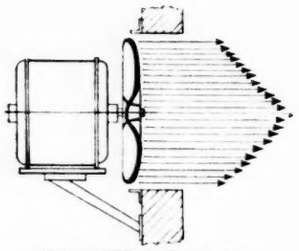
Save fuel with McCord Unit Heaters.

McCord CORPORATION
DETROIT 11, MICH.

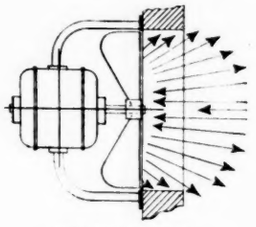
STILPHEN "Stil-Blade"

Exhaust Fans

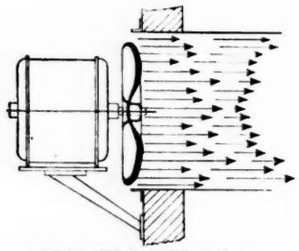
Proved by Years of Performance



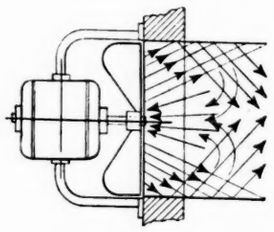
Stilphen "Stil-Blade" Exhaust Fan—without duct work



Steel Blade Exhaust Fan—without duct work



Stilphen "Stil-Blade" Exhaust Fan—with duct work



Steel Blade Exhaust Fan—with duct work

Results of Impartial Performance Tests

Outstanding efficiency of Stilphen "Stil-Blade" Exhaust Fans is due to special design of fan wheel which has reverse curve at back edge of blade insuring quiet operation, minimizing air friction and eddy currents. Wheel is cast of aluminum alloy in one piece, eliminating chance of blades working loose and throwing fan wheel out of balance.

Write for information. Howry-Berg Steel & Iron Works, 2949 N. Speer Blvd., Denver 11, Colo.

HOWRY-BERG

C. C. McDermond has been appointed representative of the welding fittings division of **Tube Turns, Inc.**, in Venezuela and Colombia, S. A. McDermond and his assistant, **C. T. McCoy**, make their headquarters in Apartado No. 331, Maracaibo, Venezuela.

The staff of **Consolidated Industries, Inc.**, Lafayette, Ind., manufacturers of automatic heating products, has been augmented by the addition of **C. J. Merritt**, heating research engineer. He will be in charge of research and design on gas heating equipment.

C. J. Merritt

Consolidated Industries has also appointed **Vernon L. Beery** to be in charge of field service and installation in the stoker division.

W. A. Davies has joined Consolidated Industries as regional sales manager for Virginia, Maryland, Delaware, North Carolina and South Carolina.

Purchase of a new plant and plans for construction of additional manufacturing facilities by **Minneapolis-Honeywell Regulator Co.** have been announced. The new expansion moves are in addition to the company's previously announced $4,000,000 program which includes the construction of a new wing to the company's main plant, the work on which already has begun. Honeywell has acquired from the Heidbrink division of the Ohio Chemical and Manufacturing Co. the two-story plant adjacent to its main plant in Minneapolis. Of brick construction, the new factory contains approximately 22,000 ft of manufacturing space with footings for the addition of a third floor.

Everett B. Evleth, formerly vice-president and general manager of the Brown Instrument Co., has established his own business as an industrial consultant. He has opened an office in the Terminal Commerce Building, 401 No. Broad St., Philadelphia.

The Pittsburgh Corning Corp. has announced plans to build two plants at Sedalia, Mo., for the production of glass block and Foamglas, a cellular glass insulating material. Estimated cost of the expansion program is $2,000,000. Preliminary survey work will be started at once by the building contractor, the H. K. Ferguson Co., general contractors of Cleveland, Ohio, and New York City. The 40 acre plant site is located beyond the city limits on the west side of Sedalia.

Kieley & Mueller, Inc. (pressure regulators, liquid level controls and steam specialty equipment), has appointed the **Ryder Equipment Co.** of St. Louis, Missouri, as representatives in the State of Missouri and Southern Illinois.

David M. Ramsay recently was appointed manager of the Industrial Division of the **National Radiator Co.**, Johnstown, Pa. The Industrial Division manufactures process equipment for the chemical and petroleum industries. Mr. Ramsay has been with National Radiator for five years, having been a field engineer in the Boston office, assistant manager of the Industrial Division, and assistant to the manager of the Heating Division in charge of Specialty sales.

D. M. Ramsay

Appointment of **E. J. Sanders** as western manager of the Thermo-Aire division of **Evans Products Co.**, Detroit, is announced. Appointment of **Frank A. Chase** as central sales manager of the Thermo-Aire division, with offices in Cleveland, Ohio, has been confirmed.

H. L. Bechner and **A. D. Way** have been appointed technical manager and chief mechanical engineer, respectively, of **The Permutit Co.** In his new capacity, Mr. Bechner will be responsible for the company's technical policy on the

A. D. Way *H. L. Bechner*

application, guarantee and performance of its products which include zeolites, ion exchangers, de-aerators, chemical feeds, de-gasifiers and precipitation equipment. He will also serve as chairman of the engineering committee. Mr. Way, as chief mechanical engineer, will administer the engineering department and supervise the mechanical design and layout of equipment.

The **Spang-Chalfant Division of The National Supply Co.** has announced termination of shipments of pipe into the Chicago area and plans to close at an early date the Company's Chicago sales office which has been in existence almost fifty years. The Chicago market comprises Northern Illinois, Iowa, Nebraska, Wisconsin and Minnesota. The announcement was made by G. E. Clifford, vice-president, who said: "In view of present ceiling prices on welded pipe, and recent increase in wages, the Company finds it unprofitable to sell in the Chicago area and to absorb the freight necessary to sell on the 'Gary Base'." Spang-Chalfant will continue shipments through June.

Link-Belt Co. announces that arrangements have been made for **George P. Torrence** to rejoin the organization on July 1, as executive vice-president, and to become president of Link-Belt, November 1, 1946. He has been in Cleveland since 1936 as vice-president and general manager of The Rayon Machinery Corp., and as President of The Cleveland Pneumatic Tool Co.

Vere B. Edwards, president of **Dravo Corp.,** passed away Wednesday, May 8th, while attending a meeting of the executive committee of the corporation at its Neville Island plant. Death occurred as a result of cerebral occlusion. Mr. Edwards was fifty-six years of age. Mr. Edwards had been president of Dravo Corp. since 1934, at which time he assumed these responsibilities upon the death of the company's founders, F. R. and R. M. Dravo. After graduating from Lehigh University in 1912, Mr. Edwards joined Dravo as a junior civil engineer and during his thirty-four years with the corporation became well-known in the fields of engineering and shipbuilding. He was a member of the Duquesne Club and The Free and Accepted Masons, the Society of Naval Architects and Marine Engineers, New York, the Transportation Corps Advisory Board, U. S. Army, the Whitehall Club of New York, the Engineers Society of Western Pennsylvania, and the honorary engineering fraternity of Tau Beta Pi and was a director of the Y.M.C.A.

V. B. Edwards

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ROTARY SHEARS
DO MANY TYPES OF WORK
DOES ALL THIS WORK FOR YOU
1 CUTS STRAIGHT LINES
2 CUTS RINGS—SMALL OR LARGE RADII
3 CUTS CIRCLES
4 MAKES FLANGES
5 CUTS INSIDE HOLES WITHOUT CUTTING IN FROM EDGES
6 JOGGLES & OFFSETS
7 CUTS ODD SHAPES
8 BEVELS OF ANY ANGLE
9 CUTS REVERSE CURVES
10 BEADS & U'S
ALL WITH Hairline PRECISION

Yes, and With Hairline Precision

Rapid operation . . . Hairline Accuracy . . . the use of Kling Rotary Shears marks the latest development in cutting mild steel, and sheet metal, up to 1-inch with amazing savings in time, labor, and production costs.

For exacting projects (see illustration at the right), no single unit of metal-working equipment does so many different things so cleanly and efficiently as does the Kling Rotary, pictured above.

In metal working plants, automotive, aviation, home appliance, and other industries, where work of this character is being done, — this machine is held in high regard for its versatility and economy of operation.

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which will give you specific facts, and specifications. No obligation involved. Users of heavy equipment of Kling Rotary Shears' class will receive a copy of this Bulletin promptly, on request.

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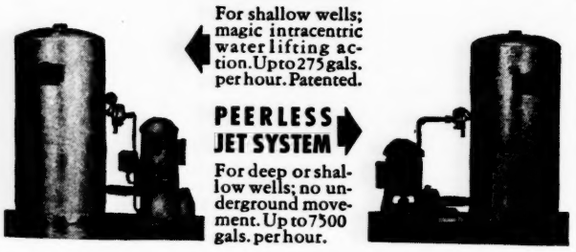

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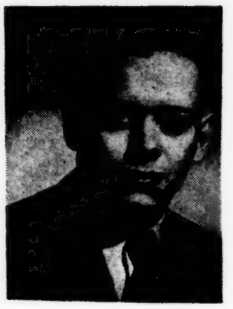
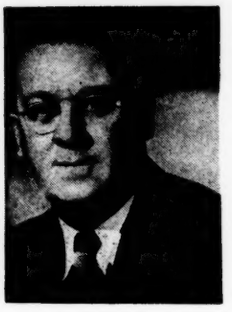
PEERLESS PUMP DIVISION
FOOD MACHINERY CORPORATION
Canton 6, Ohio • Quincy, Illinois • Los Angeles 31, Calif.

Norman Products Company, Inc., has moved into its new 10,000 sq ft plant, 1150 Chesapeake Avenue, Columbus, Ohio. The company was incorporated in August 1945 to design gas fired equipment for other manufacturers and for manufacture under its own trade name. It is headed by two experienced design and sales engineers, **E. A. Norman, Jr.**,



E. A. Norman, Jr.



D. D. Piper

president, **D. D. Piper**, secretary, treasurer and sales manager. Mr. Norman was formerly with Surface Combustion Corp., Ensign-Reynolds Co., American Gas Products and New York Consolidated Gas Co. Until recently, Mr. Piper was district manager for White-Rodgers Electric Co. Prior to that he was with Surface Combustion Corp. and Ohio Fuel Gas Co. Both men are well known in the gas appliance and utility field. Norgas Conversion Burners are now in production in the new plant. Other gas fired products will be placed on the market soon.

Jack Green, sales manager of the welding fittings division of **Tube-Turns, Inc.**, Louisville, Ky., has announced the appointment of **James H. Withers** as district manager in charge of the firm's San Francisco and Los Angeles offices. **S. M. Spears, Jr.**, has been promoted to assistant district manager of the New York office of Tube Turns.

Charles E. Klaus has been appointed **Allen-Bradley** representative for the Portland, Oregon, area, taking over the territory formerly served by Garland-Affolter Engineering Corporation. Mr. Klaus is located at 1233 N. W. 12th Avenue, Portland, Oregon.

American Radiator & Standard Sanitary Corp. has announced the appointment of **John C. Reed** of Louisville as manager of research and product development. Mr. Reed is a graduate of the School of Mines and Metallurgy of the Pennsylvania State College. He has been connected with the company since 1929, having started in the engineering department at the Louisville works. At the same time, the appointment of **Robert E. Daly** of Pittsburgh as director

R. E. Daly

J. C. Reed

of product engineering was announced. Mr. Daly received his engineering degree from Notre Dame in 1916. He joined the company in 1917 in their Institute of Thermal Research, Buffalo, since which time he had held various positions in the Sales and Engineering Departments of the company.

At a meeting of the board of directors of **Dravo Corp.**, on May 15, major changes were made among the corporation's top executive personnel. **J. D. Berg,** chairman of the board, resigned his position and has now been designated as chief executive officer of the corporation. He will retain his position as chairman of the executive committee. **W. K. Fitch** was elected chairman of the board of directors

C. B. Jansen *W. K. Fitch* *R. W. Marvin* *W. E. Clark*

to fill the position made vacant by Mr. Berg's resignation. Mr. Fitch began his business career in a sales capacity with Dravo-Doyle Co., one of the pioneer Dravo interests. **Carl B. Jansen** was elected president to fill the unexpired term of V. B. Edwards whose death occurred last month. He was also elected a member of the executive committee. Mr. Jansen entered the field of construction with Dravo in 1922. **Robert W. Marvin** was elected vice-president and member of the executive committee. Mr. Marvin has been associated with Dravo interests since 1927. **W. E. Clark** was elected a member of the board of directors. Mr. Clark became salesman in 1925 for Keystone Sand & Supply Co., the second of the pioneer Dravo companies.

At a meeting of the board of directors of the **United States Radiator Corp., Wesley J. Peoples,** Detroit industrialist, was elected chairman of the board of directors and acting president of the company. Mr. Peoples will serve without compensation. **L. Gillespie Erskine,** former president and chairman, continues as a director and also as consultant to the company. **Carroll M. Baumgardner,** vice-president in charge of sales, was elected executive vice-president, and all other officers of the company were re-elected.

Harvey-Whipple, Inc., has announced the promotion of **William C. Dee** of Utica, N. Y., who has covered upstate New York for Harvey-Whipple over the past fifteen years, to the position of field service engineer. He will now head the field engineering force contacting Master Kraft domestic oil heating dealers in 35 states and Canada.

Air Devices, Inc., engineers and manufacturers of Agitair products, announce the appointment of **R. W. Christie** to the newly created post of research engineer. Mr. Christie, previously associated with the U. S. Testing Company, will supervise all research and laboratory work. **J. Keselis** has been made production manager and will be responsible for the manufacture of Agitair air filters, diffusers, exhausters, etc. **T. A. Hughes,** formerly advertising and sales promotion manager for Westinghouse Air Conditioning, is now manager of sales promotion of all Agitair products including hot water generators and oil-fired hot gas generating furnaces.

T. A. Hughes

The Sawhill Mfg. Co., Sharon, Pa., announces two new representatives for Sawhill pre-fabricated pipe. **James W. Roy** of James W. Roy Co., Boston, Mass., will represent Sawhill in New England. **C. C. Abbott** will make headquarters in Cincinnati, O., and travel Southern Ohio.

with Tal's Portable, Hydraulic Bender

● Bending pipe on the job is making **more money** for those contractors alert enough to get behind radiant heating with the right equipment—a Tal portable pipe bender. This best engineered machine bends cold to any angle all wrought iron or steel pipe ⅜" to 3" in one single, fast moving operation. It reduces the need for welds by from 40% to 80% — speeds up installation work. Used now by leaders who know it repays its low cost many times a year. Write for bulletin

Tal's Prestal Bender, Inc.

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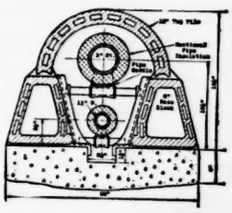

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- ☐ Enclosed is a rough sketch of a prospective underground pipe job.
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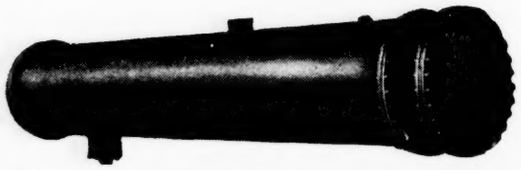
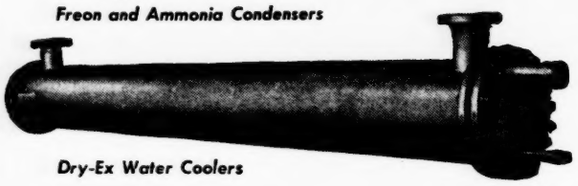
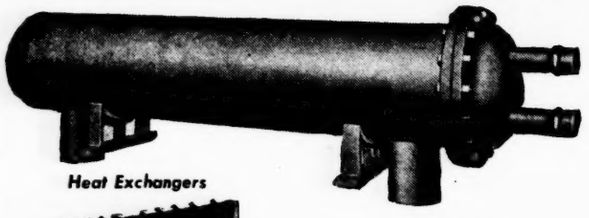


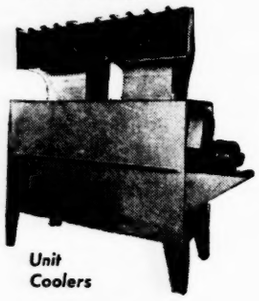
Freon and Ammonia Condensers



Dry-Ex Water Coolers



Heat Exchangers



Unit Coolers

Oil Separators

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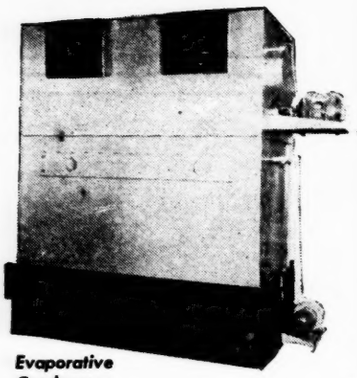
Refrigeration and Air Conditioning Equipment



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The Hammel-Dahl Co. of Providence, R. I., manufacturers of automatic control equipment, announces the appointment of **Wayne B. Farley** as district manager of their Pittsburgh office, covering West Va., Eastern Ohio and Western Pa. For the three years prior to joining the Hammel-Dahl organization, he was chief plant layout engineer for the Blaw-Knox Co. of Pittsburgh, Pa. During the pre-war years, Mr. Farley headed the hydrocarbon department of the Austin Co.

W. B. Farley

A new firm for the sale of special equipment in process engineering has been organized by **W. H. Davidson** and **H. E. Serner** with offices at Commercial Trust Building, Philadelphia, Pa., and 342 Madison Avenue, New York, N. Y. The firm will primarily be interested in fields of special heat exchange processes and steam jet refrigeration including oil and diphenyl ... d special furnace design.

A new program to provide more accurate and dependable values of thermal conductivity for most of the insulating materials on the market has been initiated by the Committee on Research of **ASHVE.**

Additions to the sales engineering staff in four branch offices of the **Ilg Electric Ventilating Co.** have been announced. **G. K. Wood** has been appointed manager of the branch in Columbus, Ohio. **A. B. Davis** has been assigned to the office in Charleston, W. Va. **Carl E. Brook, Jr.** has joined the Pittsburgh branch. **Frank Taylor** has been assigned to the New Orleans branch.

The mid-year convention of the **National Warm Air Heating and Air Conditioning Association** at the Edgewater Beach Hotel, in Chicago, on June 25 and 26, will be the first since December 1944. President Mehrings calls attention to the fact that **Dr. Arthur C. Willard,** president of the University of Illinois, will be guest speaker at the luncheon to be held in the Marine dining room of the Edgewater Beach.

John R. Cassell Co., Inc., 110 W. 42nd St., New York 18, N. Y., has been appointed exclusive manufacturer's distributor in the United States and Canada for the "Instrumaster" line of mechanical drawing accessories made by **Instrumaster Industries, Inc.,** 73 Arch St., Greenwich, Conn.

Colonel A. H. Anderson who, before he left for duty with the U. S. Army, had been with the **Bacharach Industrial Instrument Co.** since 1923, has returned to the company as manager of the Heating Division, treasurer and a member of the board of directors. Because of the entry of the company into instrumentation for the refrigeration and air conditioning trades, and its expanded activities in the heating field, he will devote his entire time to the management of this division.

A. H. Anderson

Vilter Mfg. Co. announces the following promotions in personnel: **Albert O. Vogel** has been appointed general sales manager; **Erich J. Kocher,** chief engineer; **W. H. Hartmann,** credit manager; **Donald F. Ahlswede,** production control manager.

Kenneth W. Browning has been appointed sales promotion manager for **Rheem Mfg. Co.'s** heating equipment division. He will make his headquarters in Chicago.

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Many foremost manufacturers, having discovered our specialized skill in our particular line, have entrusted us with a great variety of precision pipe and tube work, including bending, coiling, expanding, flattening, brazing and welding.

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When you want accurate and dependable automatic temperature or humidity control for Heating, Ventilating and Air Conditioning Systems or Industrial Processes call in a Powers engineer. With a very complete line of self-operating and compressed air operated controls we are well equipped to fill your requirements.

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FOR AUTOMATIC and REMOTE CONTROL
AIR • GAS • STEAM • LIQUID

A wide range of electric; thermostatic; and mechanical valves for all control needs. Carefully engineered to handle your problem. Write or wire today—we believe we can help you.

VALVES FOR ALL PURPOSES

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347 Market St., Palmyra, New Jersey

Get Full Cooling Capacity From Your Air Conditioning Equipment!

Slime and scale are quick to clog drains, sprayheads, piping and pumps of air conditioning equipment . . . cut operating efficiency.

Control the formation of troublesome deposits with a specialized Oakite additive. Simply introduce recommended Oakite material into circulatory water system. The lime-solubilizing characteristics and fungistatic properties of this chemical water-conditioner inhibit slime-growth, prevent lime-scale build-up . . . keep lines free-flowing for full cooling capacity!

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